Dräger

Infinity Configured Monitoring Series

Infinity Gamma Series User's Guide

ACE
Arrhythmia Classification Expert

Inside!

OxiSure™

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Infinity Gamma Series User's Guide
Software Version VF4

This product is covered by one or more of the following patents: 5,224,484;
5,224,740; 5,240,008; 5,285,791; 5,355,890; 5,337,751; 5,375,604.

This device bears the $C\epsilon$ label in accordance with the provisions of the Directive 93/42/EEC of June 14, 1993 concerning medical devices.

$C\epsilon$ **0123**

All Dräger devices are intended for use by qualified medical personnel only.

⚠ **CAUTION:** *Federal Law in the United States restricts these devices to sale by, or on order of a physician.*

Before using all Dräger devices, read all the manuals that are provided with
your device carefully. Patient monitoring equipment, however sophisticated,
should never be used as a substitute for the human care, attention, and critical
judgment that only trained health care professionals can provide.

What's New

The functionality of the Infinity Gamma Series patient monitor has been improved and expanded to include the following new features in software version VF4:

■ Support of gas monitoring functions in anesthesia and operating room environments. The Gamma XL can now display concentrations of CO_2, N_2O, O_2 and of the anesthetic agents halothane, isoflurane, enflurane, sevoflurane, and desflurane. The Gamma XL receives these gas values from a Dräger Scio multigas module. Note: This functionality is only available for the Gamma XL (and not the Gamma). For information about multigas monitoring, see Chapter 14, *Multigas*.

■ Support of network laser printers. Recording requests can be sent from the Infinity Gamma Series monitor via the Infinity network to a network laser printer. For information about recording functions, see Chapter 7, *Recordings*.

■ Improved SpO_2 performance during motion artifact. For information about pulse oximetry, see Chapter 12, *Pulse Oximetry*.

➤ **NOTES:**

■ The Gamma XL monitor with Anesthetic Gas Monitoring requires FDA 510(k) review.

■ The Gamma XL monitor with Anesthetic Gas Monitoring is not yet licensed in accordance with the Canadian Medical Devices Regulations.

Infinity Gamma Series Software Release Notes

Software Version VF4

■   Wireless network operation requires special configurations of the monitoring network and the MULTIVIEW WORKSTATION (a service function). If you experience problems with wireless network operations, contact your Service personnel.

■   When moving and assigning a wireless monitor to a different central station, the original central station may emit a brief network error tone and display an *Offline* message instead of the message *Bed Disconnected.* However, there is no disruption of network monitoring and the *Offline* message clears as soon as you assign a new bed to the central viewport.

■   When you change the units of measure at the bedside and the central station is showing the monitor's bed view, you must first exit the central bed view, before the change of units appears at the central station.

■   For network and card data transfer:

— Occasionally, after a data transfer from an Infinity Delta Series monitor, you may see three or four ST trends instead of the two ST leads monitored by the Infinity Gamma Series monitor.

■   For network data transfer only:

— If ST is enabled, the ST data transferred from an Infinity Delta Series monitor (VE0) or from a MULTIVIEW Telemetry System (VE0) is ST lead I and II, regardless of the ST leads selected on the Infinity Gamma Series monitor. **Note**: Other ST data will be permanently lost.

— After a network transfer of telemetry data to an Infinity Gamma Series monitor, ST trend points may appear two minutes apart.

— The IBP data transferred from an Infinity Delta Series monitor (VE0) to an Infinity Gamma Series monitor is labelled GP1 and GP2.

■   NBP parameter values transferred from an Infinity Gamma Series monitor to an Infinity Delta Series monitor will be displayed in the trend graphs rather than in the trend tables of the destination monitor.

■   On rare occasions, a docked monitor may reset when entering the Transfer Menu under certain network conditions. The monitor returns to the state prior to the reset within 30 seconds.

■   When power-cycling the monitor or admitting a new patient, saved monitoring settings may occasionally return to default settings. Check monitoring settings after these events.

■   If the Scio module is unable to measure the concentration of N_2O, the monitor may enter the error code *A* (artifact) instead of *F* (failure) into the trend storage.

- Occasionally, the ECG waveform is not displayed in the second waveform channel, when you assign SpO_2 to the first waveform channel. In this case, click on the second waveform channel and select the desired ECG lead again.

- When admitting a patient at the MULTIVIEW WORKSTATION, the monitor does not store the admit date, if it is the current date. In this case, you must enter the admit date via the monitor's Patient Admit menu.

- When the values of an anesthetic agent exceed the measuring range, the monitor displays +++ in the agent parameter box and cycles two out-of-range error messages, one correctly identifying the agent with out-of-range values, the other showing a previously monitored agent.

Documentation Features

Notes, Cautions, Warnings

NOTE: A note presents information that helps you operate the equipment or connected devices.

CAUTION: A caution provides information or instructions that must be followed to ensure proper operation and performance of the equipment.

WARNING: A warning contains important information regarding possible danger to you or the patient that is present during normal operation of the equipment.

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1 Overview

Important General Safety Considerations

CAUTION: *Read all operating instructions carefully before using the monitor. Specific warnings and cautions are found throughout the User's Manual where they apply.*

CAUTION: *These devices are not intended for use in the same room as magnetic resonance equipment.*

WARNING: Monitor operation is currently not supported in the following environments: magnetic resonance imaging (MRI), aircraft, ambulance, home or hyperbaric chamber environments.

CAUTION: *Use only batteries that are approved by Dräger (contact your local representative). The use of non-approved batteries may damage the device.*

NOTE: Dräger recommends replacing any lead-acid battery after 12 months of continued use. For safe disposal of lead-acid and lithium ion batteries, follow your local regulations. To prevent risk of fire or explosion, never dispose of the battery in fire.

Dräger is liable for the safety, reliability and performance of its equipment only if (a) maintenance, repairs, and modifications are carried out by authorized personnel, (b) if components are replaced with Dräger approved spare parts and (c) if the devices are used in accordance with Dräger Operating Instructions.

A full technical description is available upon request from your local Dräger representative.

Electromagnetic Compatibility

The monitor has been designed and tested for compliance with current regulatory standards as to its capacity to limit electromagnetic emissions (EMI), and also as to its ability to block the effects of EMI from external sources.

The monitor complies with the following standards pertaining to EMI emissions and susceptibility: EN55011 and EN60601-1-2.

Reducing EMI

To reduce possible problems caused by electromagnetic interference, we recommend the following:

- Use only Dräger-approved accessories.

- Ensure that other products used in areas where patient monitoring and/or life-support is used comply to accepted emissions standards (EN55011).

- Try to maximize the distance between electromedical devices.

- Strictly limit exposure and access to portable radio-frequency sources (e.g., cellular phones and radio transmitters). Be aware that portable phones may periodically transmit even when in standby mode.

- Maintain good cable management. Do not route cables over electrical equipment. Do not intertwine cables.

- Ensure all electrical maintenance is performed by qualified personnel.

Site of Operation

CAUTION: The site of operation for the monitor must meet temperature, humidity, and air pressure requirements. For details, see the product description in Appendix A.

WARNING: Do not operate the monitor in presence of flammable anesthetic mixtures with air, oxygen, or nitrous oxide. Do not use the monitor near devices with microwave or other high frequency emissions that may interfere with the monitor's operation.

WARNING: If fluids are accidentally spilled on the monitor, it should be removed from service immediately and thoroughly inspected by your Biomed to ensure that there is no compromise in electrical safety.

CAUTION: Place the monitor on a flat and stable surface to prevent it from falling. Do not place the monitor into a cabinet, wall recess or similar enclosure during operation. These units are convection cooled (no fan) and need adequate airflow to dissipate heat.

Electrical Safety

CAUTION: *Operate the monitor and any connected devices only in a clinical environment where the electrical installation is in accordance with local electric codes. The universal AC adapter, CPS, or IDS should be connected to a fully tested, hospital-grade outlet with proper grounding.*

WARNING: Dräger devices are not intended for use in areas where there is a danger of explosion. If the devices are used where flammable anesthetic substances are used, the possibility of an explosion cannot be excluded.

If the AC adapter, CPS, or IDS is disconnected, the monitor "Battery charger" light turns off and the unit switches immediately to battery power.

Connections to Peripheral Devices

All peripheral devices and connections to the monitor (except the Infinity network) must comply with IEC 60601-1 requirements.

CAUTION: *In the interest of patient safety and equipment performance, Dräger does not authorize the connection of other manufacturers' equipment not approved by Dräger. It is the user's responsibility to contact Dräger to determine compatibility and warranty status if connections to other manufacturers' equipment are desired.*

CAUTION: *When connecting peripheral devices to the monitor, make sure that the entire system complies with the following requirement: IEC 60601-1-1: Safety requirements for medical electrical systems.*

Safety, Inspection, and Maintenance

WARNING: Because of the danger of electric shock, never remove the cover of any device while in operation or connected to a power outlet via the AC adapter.

In the interest of safety, regular equipment inspection and maintenance is required. Once a year, check all cables, devices, and accessories for damage, ground resistance, chassis and patient leakage currents, and all alarm functions. Also, ensure that all safety labels are legible. Maintain a record of these safety checks. For additional information, refer to the Service manual.

Leakage current will increase when connecting multiple medical devices to a patient. Ensure the electrical shock classification for each device is suitable for the intended application.

Dräger recommends that safety and functional checks be performed on the monitor *at least* once each year. The temperature and non-invasive blood pressure circuits of the monitor should be calibrated at least every two years. These checks should be performed by authorized personnel, as described in the appropriate Service manual.

When main or battery power is not available, the monitor stores patient data and settings in an internal battery backed-up SRAM. This internal battery will last approximately 10 years if the monitor is operated from main power or from the lead acid or lithium ion battery.

CAUTION: To preserve the life of the internal battery, always leave the monitor connected to main power (using the AC adapter) when not in use. If the monitor is stored <u>unconnected</u> from line or lead acid/lithium ion battery power, the capacity of the internal battery will be drained in approximately three years.

Electrosurgery and Defibrillation Safety

The monitor is protected against high-frequency interference from electrosurgery units and discharges from defibrillators, as well as against 50- and 60-Hertz power line interference.

WARNING: The monitor is not protected against high-frequency interference from diathermy equipment.

CAUTION: During Electrosurgery, observe the following guide-lines to minimize ESU interference and provide maximum user and patient safety:

- *Use the ESU block to connect ECG cables.*

- *Keep all transducers and intermediate cables off of earth ground and away from the ESU knife and return wires.*

- *Use the SpO_2 pulse rate instead of the ECG to determine the heart rate.*

- *Use rectal temperature probe sheaths to cover any internally placed temperature sensors.*

- *Always use the accessories designed for ESU environments.*

- *If pacer detection is on, the ESU interference may be detected as pacer spikes displayed on the ECG.*

Pacemaker Safety

WARNING: Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveillance.

WARNING: Make sure that pacer detection is turned off for patients without pacemakers, and turned on for patients with pacemakers.

Device Markings

⊙ ⟳   Power On/Off, Power standby.

⊣⊢   Battery operated equipment.

⚠   Attention, consult the accompanying documents.

⊣♥⊢   Type CF, defibrillator-proof equipment.

= = =   Direct current.

~   Alternating current.

       Danger: Risk of explosion if used in presence of flammable anesthetics.

CE 0123   This device bears the CE label in accordance with the provisions of the Directive 93/42/EEC of 14June 1993 concerning medical devices.

IPX1   Protected against harmful effects of dripping water.

NBP   Non-Invasive Blood Pressure.

IBP   Invasive Blood Pressure.

General Description

The Gamma Series monitor is a durable, lightweight, and portable patient monitor that can operate as a stand-alone device or as part of the Dräger Infinity network. The Dräger PICK AND GO™ concept allows the monitor's quick and easy disconnection from the network, and the monitor can travel with the patient from one clinical station to another — i.e. from the bedside to the OR to a step-down unit and back.

The monitor provides high-quality patient care for adult, pediatric, and neonatal patients in clinical environments.The monitor provides high-quality patient care for adult, pediatric, and neonatal patients in clinical environments and offers the following monitoring functions:

- ECG and Heart Rate Monitoring (3-, 5-, and 6-lead).

- Arrhythmia Detection (Basic and Full).

- 2-lead ST Segment Analysis (adult and pediatric mode only).

- Respiration Monitoring (impedance pneumography).

- Pulse Oximetry.

- End-tidal CO_2 Monitoring.

- Anesthetic Gas Monitoring (Gamma XL only).

- Temperature Monitoring.

- OxyCardiorespirogram (neonatal mode only).

- Non-Invasive Blood Pressure Monitoring.

- Invasive Blood Pressure Monitoring.

- Trend Storage.

- Event Storage.

- Recordings.

- Patient Data Transfer (via PC Card or Network).

- Wireless Network Operation.

The monitor Gamma has a 6.5", the monitor Gamma XL an 8" color display. Both monitors have a rechargeable battery. A universal AC adapter is available for connection to a hospital- grade outlet.

When used as a stand-alone device, you can connect the following peripheral equipment to the monitor via the monitor's interface plate:

- An R50 Series recorder for printing alarm data, waveforms, trends, and diagnostic logs.

- A nurse call system for broadcasting life-threatening, serious, and advisory alarms.

- A VGA remote display for viewing monitoring data on a larger screen.

For exporting data to external devices, the monitor provides a fast synchronization output (i.e. for defibrillators) and an RS232 connector (via an interface plate or an Infinity Docking Station/CPS Communication Power Supply).

When operating within the Infinity network, the monitor communicates with other network devices and with the MULTIVIEW WORKSTATION™ (central station), allowing central monitoring of bedside data.

For more information on network operation, refer to the chapter *Network Application*.

You can transfer patient data between monitors with the help of a Data Memory PC Card or via the network. For information on data transfer, see the chapter *Admission, Transfer, Discharge*.

Front Panel
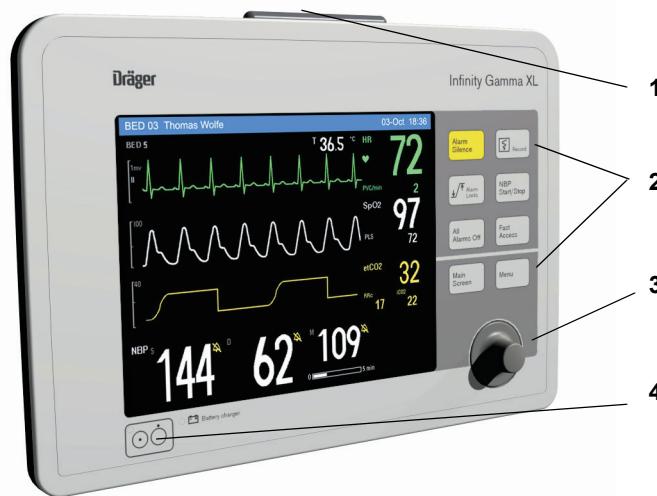
1) Alarm Light

2) Fixed Keys

3) Rotary Knob

4) Power ON/OFF Key

Back Panel
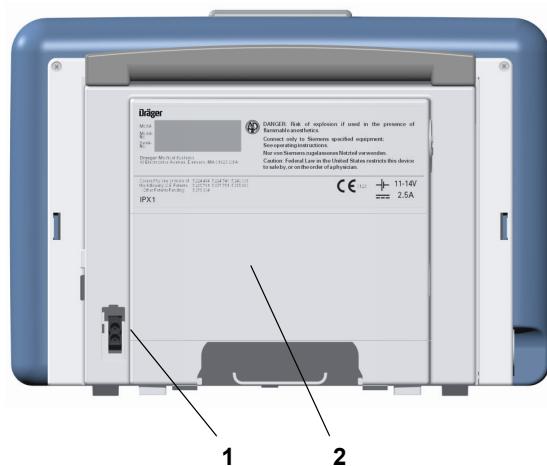
1) Power Supply Connection

2) Battery Compartment Cover

Left Side Panel
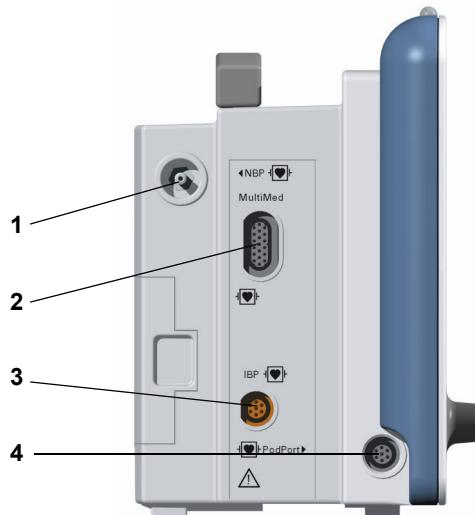
1) NBP Hose Connection

2) MULTIMED/NEOMED Connection

3) Invasive Blood Pressure Connection

4) PodPort (optional etCO$_2$ Pod Connection)

Right Side Panel
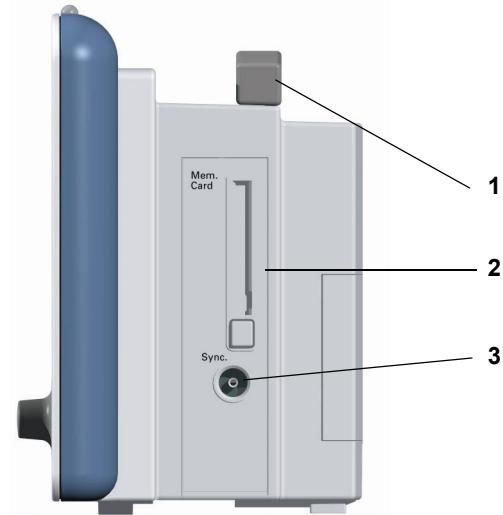
1) Carrying Handle

2) Memory Card Slot

3) QRS Sync. Output

Interface Plate (optional)

1) X5: External VGA/Scio Multigas Module

2) X7: Alarm Output/R50 Recorder/RS232

Gamma/Gamma XL Display
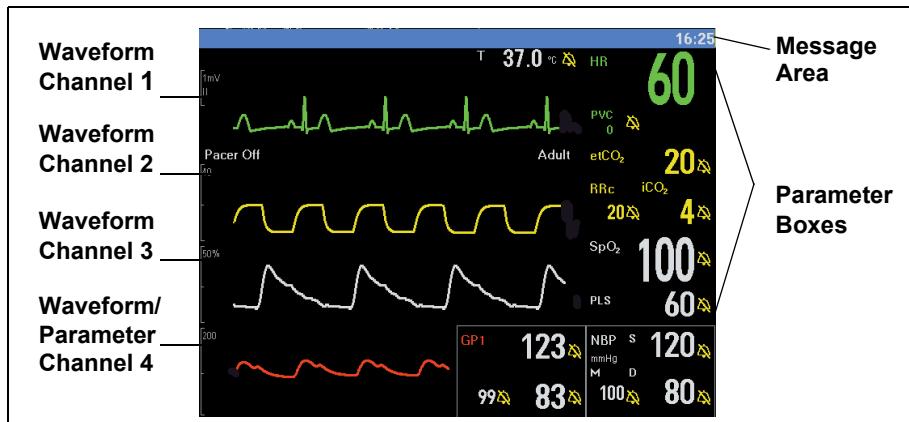
NOTE: The fourth display channel is available as an option for the Gamma monitor, but standard on all monitors Gamma XL. For information on screen configuration, see the chapter *Monitor Setup*. For information on the fourth channel option, please contact your Dräger representative.

Alarm Colors

Colors are used to call your attention to important events:

- Black letters on a red background are used for life-threatening alarms and their messages (e.g., *Asystole*).

- Black letters on a yellow background are used for serious alarms and their messages (e.g., *Rsp Too High*).

- Black letters on a white background are used for advisory alarms and their messages (e.g., *Rsp Lead Off*).

- Amber letters on a dark gray background are used for network messages (see the *Network Applications* chapter for details).

- White letters on a blue background are used for messages and information unrelated to the network (e.g., *Battery Charging*).

Display Colors

The use of colors on the monitor allows you to identify a parameter and its waveform quickly. The following colors are predefined and cannot be changed:

Heart rate	Green
PVC/ARR	Green
ST Segment Analysis*	Green
SpO$_2$/PLS	White
Respiration	Blue
etCO$_2$*, iCO$_2$*, RRc*	Yellow
Multigas Parameters	O2-white, N2O-blue, ISO-purple, ENF-orange, HAL-red, DES-blue, SEV-yellow
ART, GP1, GP2*	Red
PA	Yellow
CVP, ICP	Blue
*Options	

The parameter color extends to the following display elements:

- Parameter label.
- Parameter waveform.
- Parameter trend labels and graphs.

If the parameter box appears next to its waveform on the screen, the values are also displayed in the appropriate parameter color. Otherwise, the values are white.

Exceptions: For NBP and Temperature parameter and units, the trend graph, trend label and parameter label are white, and no waveform is available.

Rotary Knob

Using the rotary knob, you can:

- Select a screen area (parameter box or waveform field).
- Call up a menu and change menu options.
- Scroll through trend tables and graphs.
- Scroll through stored events.
- Switch between trend tables and graphs.

STEPS: Calling up a menu

1. Turn the knob clockwise or counterclockwise to navigate the screen. Selected areas appear framed.
2. Press (click) the knob to call up a screen area's menu (a parameter menu or a waveform channel menu).

STEPS: Changing menu options

1. Dial to highlight the desired menu option.
2. Press the knob to activate the option.
3. Dial in the desired setting.
4. Press the knob to confirm the change.
5. To exit the menu, press the **Main Screen** fixed key.

Fixed Keys

The monitor has a Power ON/OFF key and eight fixed keys on the front of the unit. These keys give the user access to various monitoring functions:

⊙Ȯ **Power**	Press this key to turn the monitor on or off.
Alarm Silence	Press this key to silence an active alarm for one minute.
Record	Press this key to start a manual recording. If no recorder is connected or assigned to this monitor, the recording is stored as an event and can be viewed, printed or deleted at a later date.
Alarm Limits	Press this key to access the alarm limits table.
NBP Start/Stop	Press this key to start a manual NBP measurement, or to stop one in progress.
All Alarms Off	Press this key to silence all alarms for three minutes.
Fast Access	Press this key to access the monitor's Bottom Channel menu as well tabular trends, graphical trends, and the Event Recall screen.
Menu	Press this key to access the monitor's Main Menu.
Main Screen	Press this key to return to the monitor's main screen from any open menu or display, or to return to monitoring after Standby or a patient discharge.

Menus

Menus provide easy access to monitoring functions, including:

- Initial monitor and system setup.
- The setting of alarm functions.
- The setting of monitoring options for each parameter.

Menus are displayed in the waveform area. Use the rotary knob or a fixed key to access menus. A complete menu tree is shown at the end of this chapter.
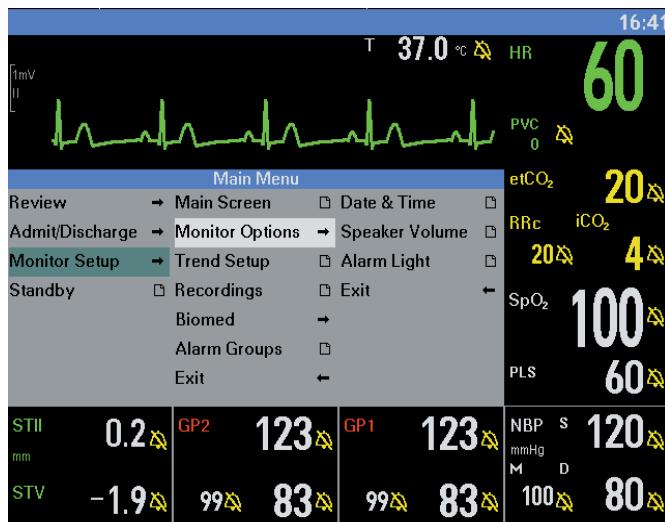
NOTES:

- Some menu items are only available, if the corresponding monitoring function has been enabled/selected (i.e. fourth waveform channel, second IBP parameter, full arrhythmia monitoring, ST monitoring, etCO$_2$ monitoring, OCRG, wireless network monitoring).
- Parameter boxes for invasive blood pressure (IBP) show the labels ART, PA, CVP, ICP or a generic pressure label (GP1 or GP2); see the chapter *Invasive Blood Pressure*.

Power Sources

The monitor can be operated with battery power or connected to line power via an AC adapter or Docking Station. See the chapter *Monitor Setup* for a description of battery operation and the AC adapter. See the chapter *Network Applications* for a description of the Docking Station and Pick-and-Go transport.

Monitor with Battery

Monitor with AC Adapter

Infinity Docking Station

MULTIMED/NEOMED Pod

For easier cable management, ECG cable sets, the SpO$_2$ sensor and temperature probes are housed in a MULTIMED or NEOMED pod. See the *Monitor Setup* chapter for information on assembling the patient cables.

MULTIMED 5 Pod and Accessories

MULTIMED 6 Pod and Accessories

NEOMED Pod and Accessories

etCO$_2$ Pod and Multigas Module

An etCO$_2$ pod for the measurement of end-tidal CO$_2$, and a multi-gas module for the measurement of O$_2$, CO$_2$, N$_2$O and five anesthetic agents are available as an option. See the chapters *End-Tidal CO$_2$* and *Multigas* for more information.

etCO$_2$ Pod

Scio Multigas Module

Recorder

You can connect a Dräger R50 Series strip-chart recorder to the monitor for the documentation of your patient's vital sign information, including trends and alarms. For information on recordings, see the chapter *Recordings*.

R50 Recorder

Remote Displays

The bedside monitor can send data to a larger VGA video display for an enhanced view of the monitoring functions. The VGA display connects directly to the Infinity Docking Station (IDS), interface plate, or the Communication Power Supply (CPS). Use of a Dräger-approved video display is recommended. For ordering information, see the Accessories appendix.

➤ **NOTE:** The remote display output on the IDS/CPS is **not** galvanically isolated. If you use a video monitor other than the one approved by Dräger, it must comply with IEC 60601-1. Upon installation, the installer must ensure that in normal and single fault conditions, the entire system meets the requirements of IEC 60601-1 and IEC 60601-1-1 (Medical Electrical Systems Standards). Refer to the video monitor's operating instructions to ensure that the interconnection is within its intended use as specified by the manufacturer. Additionally, radiated and conducted emissions classification, suitability for flammable locations and water ingress protection must be considered based on the intended use of the system.

Main Menu

Review	Trend Graphs
	Trend Tables
	Event Recall

Admit/Discharge	Patient Admit	Patient Category	Adult
			Pediatric
			Neonate
		Name	(dial in)
		ID	(dial in)
		Admit Date	(current date)
		Care Unit	(select)
		Bed Label	(select)
	Discharge	Discharge Patient?	No
			Yes
	Transfer	Care Unit	(select)
		Transfer Bed	(select)
		Start Transfer	Confirm
			Cancel
	Copy Data	Copy to Card	Name
			ID
			Start Transfer

Admit/Discharge	Copy Data	Copy to Monitor	Name
			ID
			Start Transfer

Monitor Setup	Main Screen	Bottom Channel	All
			Waveform
			Wave+NBP
			NBP
		OR Mode	ON
			OFF
		Show Rsp/etCO$_2$	etCO$_2$
			Rsp
		Screen Brightness	Dim
			Bright
	Monitor Options	Date & Time	Date
			Time
		Speaker Volume	Low
			Medium
			High
			OFF
		Alarm Light	ON
			OFF
	Trend Setup	Channel 1	(select parameter)
		Channel 2	(select parameter)

Monitor Setup	Trend Setup	Channel 3	(select parameter)
	Recordings	Primary Recorder	(select)
		Secondary Recorder	(select)
		Review	Event Recall
	Biomed	(password)	
	Alarm Groups	1 - 255	
Standby			

Fast Access Menu

Bottom Channel	All
	Waveform
	Wave+NBP
	NBP
Trend Graphs	
Trend Tables	
Event Recall	

Channel Display Menu

(1, 2, 3, 4 Channel)	Waveform	(select param.)
	Size	(param.specific)

Alarm Limits Table

(Parameter)	Upper	(dial in)
	Autoset	
	Lower	(dial in)
	Alarm	ON
		OFF
	Record	Record
		Store
		Str/Rec
		OFF

HR Menu

(HR P-Box)	Tone Source	ECG
		SpO2
	Tone Volume	Low
		Medium
		High
		OFF
	Pacer Detect	ON
		OFF
	QRS Mark	ON
		OFF

(HR P-box)	Arrhythmia Setup	Rate	(dial in)
		Count	(dial in)
		Alarm	ON
			OFF
		Record	Record
			Store
			Str/Rec
			OFF
	ECG Processing	ECG1	
		ECG1&2	
	ECG Leads	3, 5, 6	
	Arrhythmia	Basic	
		Full	
		OFF	
	Relearn	(last relearn)	

Rsp Menu

(Resp P-Box)	Resp Mode	Manual
		Auto
		OFF
	Resp. Marker	ON
		OFF
	Relearn	(last relearn)
	Apnea Time	10 . . . 30
		OFF
	Coincidence	ON
		OFF

Multigas Menu

(Agent P-Box)	Agent Override	Isoflurane
		Enflurane
		Halothane
		Desflurane
		Sevoflurane
		OFF
	Multigas Alarms	(alarm table)
	Autozero Delay	

etCO$_2$ Menu (with POD)

NOTE: If Scio rather than the pod is the etCO$_2$ source, the etCO$_2$ menu shows only the selection RRc Apnea.

(etCO2 P-Box)	etCO$_2$ Source	POD
		SCIO
	Averaging	Breath
		10s, 20s
		Instant.
	RRc Apnea	10 . . . 30
		OFF
	Sensor Cal.	
	Adapter Cal.	
	Balance	Air
		N2O/O2
		>60% O2
		Heliox
	Meas. Mode	Main
		Side
	Insp. Agent	0 . . . 20
	Exp. Agent	0 . . . 20
	Atm. Press. Mode	Auto
		Manual
	Atm. Pressure	400 . . . 800

SpO$_2$ Menu

(SpO2 P-Box)	Tone Source	ECG
		SpO2
	Tone Volume	Low
		Medium
		High
		OFF
	Bar Graph	ON
		OFF
	Averaging	Normal
		Fast
	Sensor Type	(informational only)

ST Menu

(ST P-Box)	ISO	(place point)
	ST	(place point)
	Ref	ON
		OFF
	Save	(last save)

NBP Menu

(NBP P-Box)	Interval Mode	2 . . . 240
		OFF
	Calibration Mode	ON
		OFF
	Inflation Mode	Adult: 270
		Adult: 180
		Ped: 180
		Ped: 140
		Neo: 140
		Neo: 90
	Measurement Tone	ON
		OFF

IBP Menu

(IBP P-Box)	Label	(select param.)
	Zero	
	Cal. Factor	80 . . . 120
	Mano. Cal. (mmHg)	1 . . . 300

2 Monitor Setup

Getting Started

⚠️ *CAUTIONS:*

- *Before monitoring your patient, the battery that is delivered with a new monitor has to be fully charged (see below).*

- *Before monitoring your patient, be sure you have read the Important General Safety Considerations in the Overview chapter.*

Using the AC Adapter

The AC adapter connects the monitor to a hospital-grade power outlet. It charges the battery during normal operation. In case of a power failure, the monitor switches to battery power without loss of monitoring data or settings.

🛑 **WARNING: Use only the AC adapter approved by Dräger. Using a non-approved power supply could damage the monitor. Dräger assumes no liability for any damage if you use a non-approved power supply.**

STEPS: Connecting the AC Adapter

1. Connect the AC adapter's cable to the DC input on the monitor's back panel.

2. Connect the power cord to the AC adapter.

3. Plug the other end of the power cord into a hospital-grade outlet. The battery charge indicator on the front panel lights up.

4. Press the **Power** fixed key and wait until the display lights up and the monitor completes its self-test.

If the monitor does not power on, verify the connections and retry. If it fails again, take the unit out of operation and contact DrägerService.

STOP   **WARNING: If the outlet or ground conductor is suspect, operate the monitor with a battery.**

Using the Battery

The battery powers the monitor when the monitor is not connected to line power via the AC adapter, an IDS Docking Station, or a CPS Communication Power Supply (IDS and CPS are described in the chapter *Network Applications*). The battery fits into the battery compartment at the back of the monitor.

There are two types of batteries: lead acid, or lithium ion (shown below). Lead acid batteries provide 75 minutes of continuous monitoring; lithium ion batteries provide 180 minutes of continuous monitoring.
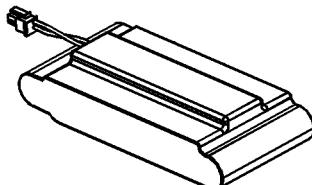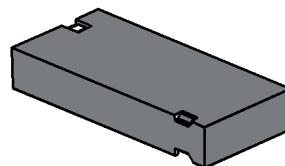
Lithium Ion Battery   Lead Acid Battery

Lead acid batteries can be installed or removed by the user. **Lithium ion batteries must be installed or removed by Dräger personnel.** The green battery gauge displayed at the bottom left of the screen indicates the battery run time remaining for uninterrupted monitoring.

> **NOTE:** The battery gauge appears only when you operate the monitor on battery power.
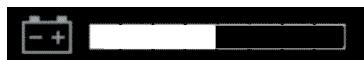
When the battery charge is less than approximately 25%, the following happens:

- The battery gauge displays in yellow.
- The monitor emits an alert tone.
- The monitor displays the message *Replace Battery Pack* at frequent intervals.

If the battery charge drops below 10 V, monitoring stops, but monitoring settings, trended data, and stored recordings are saved in memory.

Screen Brightness

To save power, the monitor's display may automatically dim when you change to battery operation.

With a lead acid battery, the display always dims on battery power. With a lithium ion battery, you can choose whether or not the displays dims.

The Brightness setting remains in effect through a power cycle. Regardless of the setting, lithium ion batteries can power the monitor for at least three hours, even if the display remains bright during battery operation.

➤ **NOTES:**

■ The menu option Screen Brightness only appears when the monitor is equipped with a lithium ion battery.

■ This function is only supported with recent releases of the micro-controller code. If the Screen Brightness option is not available in the menu, although a lithium ion battery is installed, an update of the micro-controller code is necessary (contact your Dräger representative).

STEPS: Selecting the Screen Brightness

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Main Screen**.

4. Click on **Screen Brightness**.

5. Select **Dim** or **Bright** and click the knob.

STEPS: Inserting a Lead Acid Battery into the Monitor

➤ **NOTE:** Before installing the battery, read the cautions and warnings in the *Important General Safety Considerations* section at the beginning of this manual.

1. Turn the monitor so that its rear panel is facing towards you.

2. Press in on the tab in the right side of the battery compartment door and swing the door open until it lifts off the hinges on the left side.

3. Insert the rechargeable battery in the compartment, electrical terminals side first. The terminals of the battery must be pushed into the clip in the left side of the battery compartment.

4. With the battery pushed into the left side of the battery compartment, press the right side of the battery into the clip at the right side.

5. Insert the left side of the battery door into the hinges, and swivel the door closed until the locking tab snaps into place.

6. Press the **Power** fixed key to turn the monitor on. The green light indicator in the key should light up.

7. Wait until the end of the self-tests and verify that the battery gauge appears at the bottom of the display.

➤ **NOTE:** The battery gauge appears only when you operate the monitor on battery power.

To prolong battery life, we recommend the following:

■ Use the AC adapter whenever possible.

■ Keep the battery charged.

STEPS: Charging the Battery with the Monitor

The battery that is delivered with a new monitor needs to be fully charged before monitoring. When connected to line power via the AC Adapter, IDS, or CPS, the monitor automatically charges the battery and the green Battery Charger LED lights up (the monitor can be turned on or off).

To charge the battery:

1. Connect the monitor to line power and let the lead acid battery charge for 5½ hours, the lithium ion battery for 8 hours. (The *Battery Charging* message appears intermittently.)

2. Wait until the battery is fully charged before monitoring a patient. (The *Battery Charging* message no longer appears.)

➤ **NOTE:** If the battery does not charge properly, the message *Battery Charger Error* appears. Contact your Biomedical technician to replace the battery.

STEPS: Charging Lead Acid Batteries with a Battery Charger

You can charge up to four additional lead acid batteries with the battery charger available from Dräger. To do so:

1. Place the lead acid batteries on the battery charger.

2. Keep the lead acid batteries in the charger for at least four hours to ensure a full charge.

STOP **WARNING: Use the battery charger to charge** *lead acid* *batteries only*. **Lithium ion batteries are not compatible with the Dräger lead acid battery charger.**

STEPS: Removing a Lead Acid Battery from the Monitor

1. Connect the monitor to AC power or turn the monitor off.

➤ **NOTE:** If the monitor is connected to AC power, monitoring can continue while you replace the battery. If the monitor is *not* connected to AC power, turn the monitor off before removing the battery in order to assure a proper monitor shut-down.

2. Place the monitor on a flat surface.

3. Open the battery compartment door (back of the monitor).

4. Lift the battery from under the locking tab and pull the battery out.

STOP **WARNING: To avoid explosion, do not disassemble, or dispose of the battery in fire. Do not change the battery in the presence of explosive hazards because of the possibility of sparks. If the monitor is not to be used for a prolonged time, remove the battery from the battery compartment.**

Assembling MULTIMED and NEOMED Pods

Choose a 5-lead or 6-lead MULTIMED Pod (adult/pediatric applications) or a NEOMED Pod (neonatal applications) for your monitoring session. Assemble the pods as illustrated prior to connecting them to the monitor. (Parameter-specific patient preparation is described in the individual parameter chapters.)

MultiMed 5   NeoMed

MultiMed 6
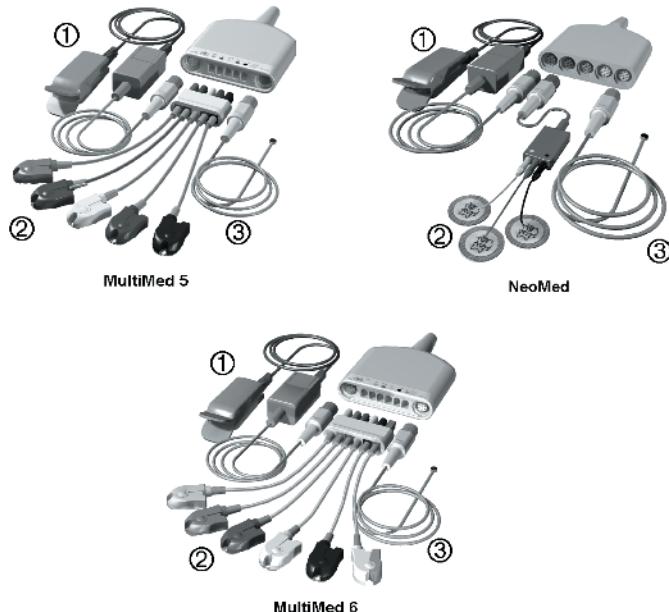
1) SpO_2 sensor   2) ECG lead sets   3) Temperature sensor

➤ **NOTE:** The FiO_2 and TEMP B connectors of the NEOMED™ pod are not supported with the Gamma Series monitors.

🛑 **WARNING: Do not use the NEOMED Pod during electro-surgery. Use during cautery may result in burns to the patient or clinical staff.**

Starting the Monitor

1. Press the **Power** fixed key. The green light indicator in the key lights up.

2. Wait until the main screen appears at the end of the self-tests.

➤ **NOTES:**

- If an internal failure or error should occur, the monitor's screen turns blank. If this should happen, turn the monitor off, then on again. In case of persistent failure, remove the monitor from service and call your Biomed technician.

- Do not use the monitor if you do not have an AC Adapter, CPS, IDS, or a fully charged battery. Call your Biomed if you are not familiar with the use of the battery or the power adapter.

Main Screen Configuration

The monitor has four display channels. The top three channels show waveforms and their corresponding parameter boxes. The bottom channel can be configured to show either parameter boxes, enlarged NBP values, a waveform, or a combination of a waveform and parameter boxes (see illustrations below).

➤ **NOTES:**

■ A fourth display channel is standard for monitors Gamma XL and available as an option for monitors Gamma. For information, contact your Dräger representative.

■ Settings for screen brightness are explained under *Using the Battery*, above.

Waveform Selection

STEPS: Selecting Parameters for Waveform Channel Display

1. On the main screen, select a waveform channel with the rotary knob and click the knob.

Channel 1 Setup	
Waveform	ECGII
Size	1mV

2. In the Channel Setup menu, click on **Waveform** and select the desired parameter or ECG lead for display. (For more information, including the ECG cascaded display, see the chapter *ECG and Heart Rate.*)

➤ **NOTE:** If you change the monitor's parameter display and the MULTIVIEW WORKSTATION is storing waveforms selected manually (Auto Track OFF), you must also change the parameters at the MULTIVIEW WORKSTATION. For more information, see the MULTIVIEW WORKSTATION's user guide.

Bottom Channel Display

STEPS: Selecting the Bottom Channel Display

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Main Screen**.

Main Menu		
Review	➡	Main Screen	▯
Admit/Discharge	➡	Monitor Options	➡
Monitor Setup	➡	Trend Setup	▯
Standby	▯	Recordings	▯
		Biomed	➡
		Alarm Groups	▯
		Exit	←

4. Click on **Bottom Channel**.

➤   **NOTES:**

  ■   You can also call up the Bottom Channel menu by pressing the Fast Access fixed key.

  ■   In OR mode, the monitor automatically displays gas values in the bottom channel and the menu selection Bottom Channel is not available.

5. Click on **All**, **NBP**, **Waveform**, or **Wave+NBP** to select one of the following bottom channel displays:
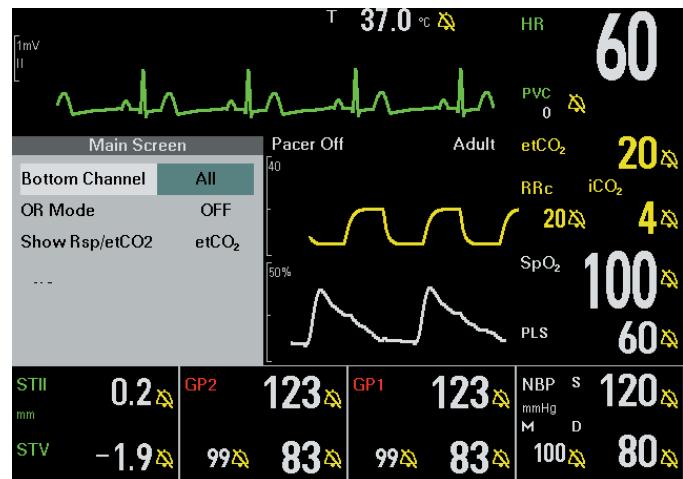
Bottom Channel showing parameter boxes
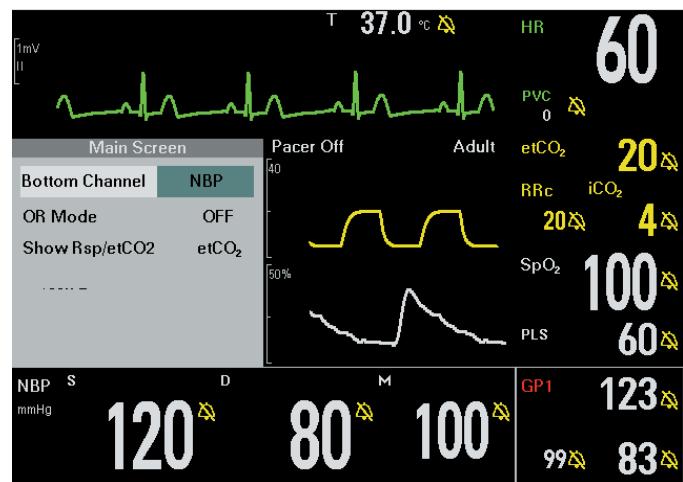
Bottom Channel showing enlarged NBP values
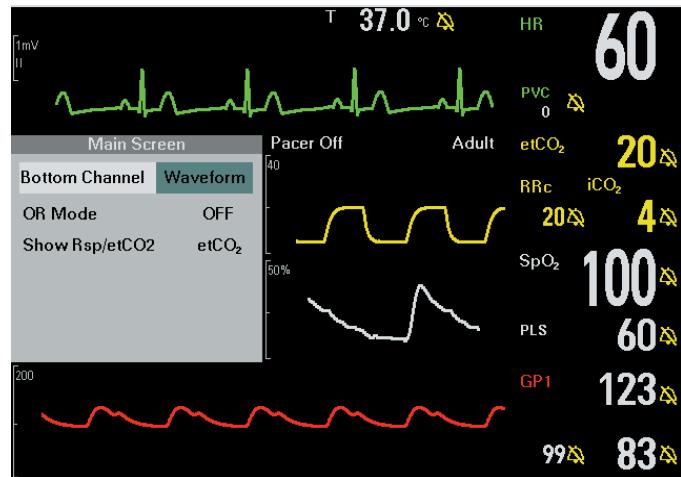
Bottom Channel showing a fourth waveform
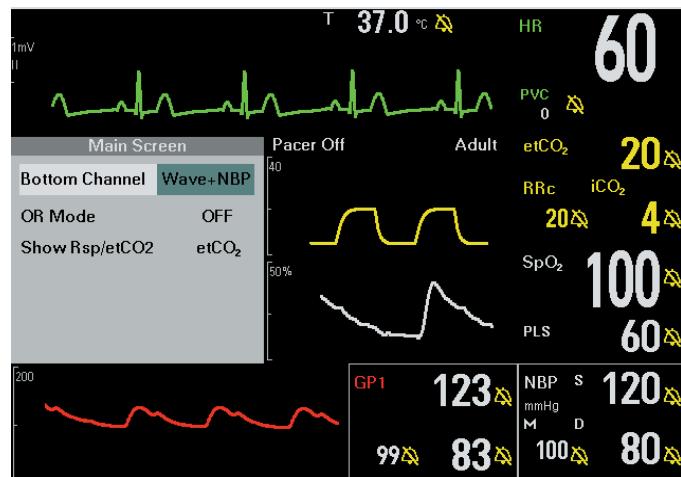
Bottom Channel showing a waveform and parameter boxes

OR Mode

The OR mode allows access to multigas monitoring functions and is available for monitors Gamma XL operating in the adult or pediatric mode.

STEPS: Selecting the OR Mode

1. Verify that the adult or pediatric patient category is selected.

2. Press the **Menu** fixed key.

3. Click on **Monitor Setup**.

4. Click on **Main Screen**.

Main Screen	
Bottom Channel	All
OR Mode	ON
Show Rsp/etCO2	etCO$_2$
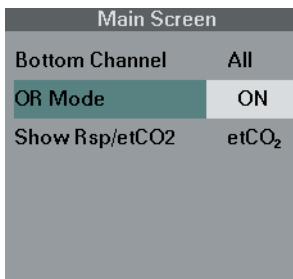
5. Click on **OR Mode**.

6. Select **ON** and click the knob.

➤ **NOTE:** Certain monitoring/display restrictions apply in the OR mode. For more information, see the chapter *Multigas*.

Show Respiration or etCO2 Parameters

STEPS: Selecting Rsp/etCO2

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Main Screen**.

Main Screen	
Bottom Channel	All
OR Mode	OFF
Show Rsp/etCO2	etCO$_2$
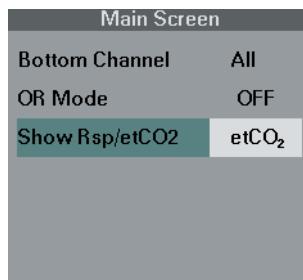
4. Click on **Show Rsp/etCO$_2$**.

5. Select **Rsp** or **etCO$_2$** and click the knob.

➤ **NOTES:**

■ For more information on Respiration or etCO2 monitoring, see the respective parameter chapters.

■ The **Show Rsp/etCO2** menu option appears only if the etCO2, ST and IBP2 locked options are enabled.

Setting Date and Time

Monitors operating in the Infinity network receive their date and time settings from the network. For a stand-alone monitor, you can set the current date and time as follows:

STEPS: Setting Date and Time

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Monitor Options**.

4. Click on **Date & Time**.

Main Menu		
Review →	Main Screen ▯	Date & Time ▯
Admit/Discharge →	Monitor Options →	Speaker Volume ▯
Monitor Setup →	Trend Setup ▯	Alarm Light ▯
Standby ▯	Recordings ▯	Exit ←
	Biomed →	
	Alarm Groups ▯	
	Exit ←	

5. Click on **Date**.

Date&Time	
Date	16–May–2001
Time	11:08
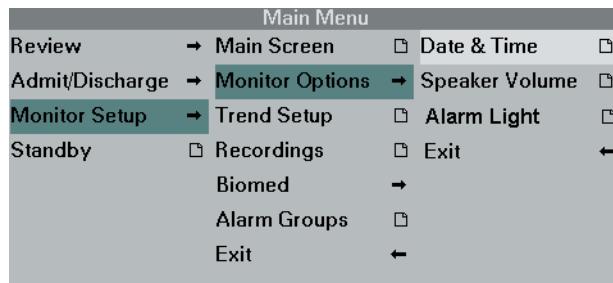
6. Click on the day, month, or year, dial in the desired setting and click to confirm the new selection.

7. Click on **Time**.

8. Click on the hour or the minutes, dial in the desired setting and click to confirm the new selection.

Setting the Master Speaker Volume

The setting for the master speaker volume defines the volume for alarm tones, pulse tones, attention and error tones. The available settings are **Low**, **Medium**, **High**, and **OFF**.

➤ **NOTES:**

■ For safety reasons, you cannot turn the speaker volume off when the monitor operates as a stand-alone device or if the French-NFC mode has been selected (a Service setting).

■ If your monitor is operating in the Infinity network and you turn the speaker volume off, a crossed speaker symbol appears above the first waveform channel.

STEPS:Setting the Speaker Volume

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Monitor Options**.

4. Click on **Speaker Volume**.

Main Menu		
Review →	Main Screen	Date & Time
Admit/Discharge →	Monitor Options →	Speaker Volume
Monitor Setup →	Trend Setup	Alarm Light
Standby	Recordings	Exit ←
	Biomed →	
	Alarm Groups	
	Exit ←	
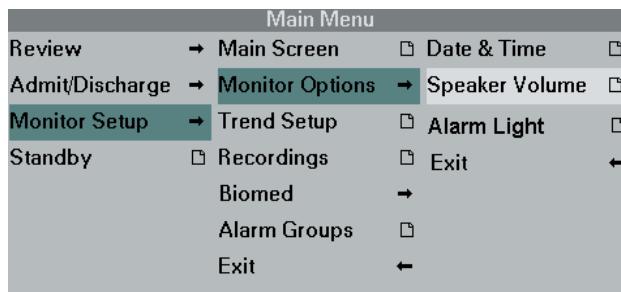
5. Click the knob, select a setting, and click the knob again.

➤ **NOTE:** The setting for the master speaker volume defines the maximum volume for all tones, including the user-adjustable QRS and SpO_2 pulse tones. Therefore, if you set the master speaker volume to Low, but set the QRS and SpO_2 pulse tones to High in the EKG or SpO_2 menu (see EKG and SpO_2 chapters), the master volume setting prevails and pulse tones sound at a low volume.

Turning External Alarm Lights ON/OFF

A set of alarm lights on top of the monitor blink red for life-threatening alarms and yellow for serious alarms, if the external alarm light function is enabled in the Monitor Setup menu (default setting is ON). If more than one alarm occurs at the same time, the lights blink for the alarm with the highest alarm grade. If the user silences the alarm, the alarm lights remain lit without flashing. If the user turns all alarms off, the alarm lights are turned off as well.

STEPS: Turning External Alarm Lights On/Off

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Monitor Options**.

Main Menu					
Review	→	Main Screen	◻	Date & Time	◻
Admit/Discharge	→	Monitor Options	→	Speaker Volume	◻
Monitor Setup	→	Trend Setup	◻	Alarm Light	◻
Standby	◻	Recordings	◻	Exit	←
		Biomed	→		
		Alarm Groups	◻		
		Exit	←		

4. Click on **Alarm Light**.

5. Select **ON** or **OFF** and click the knob again.

STOP

WARNING: The alarm light setting (ON/OFF) is not indicated on the screen. Before monitoring your patient, verify the alarm light setting in the Alarm Light menu.

➤ **NOTES:**

- The external alarm lights do not flash for advisory alarms.

- During startup, the alarm lights blink briefly as part of the monitor's functional check.

Standby

The standby function lets you interrupt and then resume monitoring. When you put the monitor into standby, all patient data and monitoring setups are saved in memory until you resume monitoring. During standby, the monitor displays a *Standby* banner. If the monitor is part of the Infinity network and its monitoring data is displayed on the central station, the *Standby* banner appears also on the central display.

STEPS:Placing the Monitor into Standby

1. Press the **Menu** fixed key.

2. Click on **Standby**.

Review	→
Admit/Discharge	→
Monitor Setup	→
Standby	▯
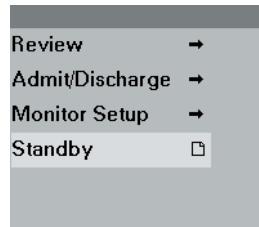
STEPS:Exiting Standby

1. To resume monitoring, press the **Main Screen** fixed key. The *New Patient?* prompt appears.

2. Select New Patient **No**, if you want to resume monitoring the same patient. Select New Patient **Yes**, if you want to start monitoring a new patient. If admitting a new patient, the monitor erases all previously stored patient data (see the chapter *Admission, Transfer, Discharge*).

New Patient?	
New Patient?	**NO**
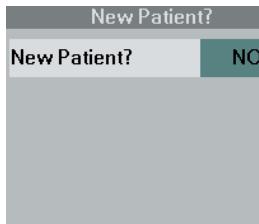
➤ **NOTES:**

- Upon startup, coming out of standby, or admitting a new patient, alarms are disabled for 3 minutes or until you press the All Alarms OFF fixed key.

- During standby, you can modify patient demographic data at the central station at any time. The new data is transferred to the monitor and available when monitoring resumes.

Saving Setups

The current monitoring configuration can be saved and used again. A saved configuration is specific to the selected patient category and is automatically restored when a you admit a new patient of the same category (e.g., pediatric).

The following monitoring settings are saved: waveform channel assignments and scales, alarm limits and on/off status, NBP interval mode, IBP pressure labels, arrhythmia monitoring (adult or pediatric mode only), respiration mode and markers, apnea time, coincidence alarm, $etCO_2$ measurement mode, pacemaker setting and detection, bottom channel display selection, recording selections (on/off/store), and trend setup.

➤ **NOTES:**

- ■ Saving setups is a password-protected function and can only be performed by your Biomed.

- ■ You cannot save a setup when an OCRG is displayed on the screen. Exit the OCRG display before saving.

3   Network Applications

➤   **NOTES:**

- The current software operates on the Dräger Infinity network, but does not support the Dräger Sirenet network.

- To assure optimal network performance of your monitoring system, make sure all network components operate at the appropriate software level as disclosed in the Dräger compatibility chart. For more information, contact your technical personnel or your Dräger representative.

Overview

The Infinity network provides communication links between the bedside monitor and other network devices such as a central station, other monitors, recorders, and laser printers. The network allows you to monitor your patient at a central location away from the bedside, and to monitor many patients at once. In detail, within the Infinity network you can:

- View patient data of up to 16 patients at a dedicated central station (MULTIVIEW WORKSTATION™).
- Admit patients at the central station.
- Receive bedside alarm messages at the central station and at other devices within the network.
- Receive alarm messages from other devices within the network at the local bedside monitor.
- Control alarms from the central station.
- Initiate a Relearn of a patient's ECG and respiration pattern from the central station.
- Set arrhythmia parameters from the central station.
- Print recordings on network recorders and laser printers.
- Transfer patients between monitors in the network.
- Collect diagnostic logs at the central station.
- View monitoring data on a larger video display.

If the monitor becomes disconnected from the network, it operates in standalone mode and the MULTIVIEW WORKSTATION displays an offline message.

➤ **NOTE:** In order to limit the number of alarm messages from remote beds within the network, you can group beds into separate alarm groups so that only messages from monitors within the same group are shared. For details see the chapter *Alarms and Messages*.

Network Configurations

A basic Infinity network includes:

- Bedside monitors.
- A central station (MULTIVIEW WORKSTATION).
- Docking stations at the bedside.
- R50 Series recorders.
- Infinity network cabling and repeater hubs.

A basic Infinity wireless network includes:

- Bedside monitors.
- A central station (MULTIVIEW WORKSTATION).
- Wireless LAN PC Cards.
- Access points with antennae.
- R50 Series recorders.
- Infinity network cabling and repeater hubs.

Dräger offers a large variety of network components and supplies that allow you to customize your hospital's network configuration. Network setup and configuration are Service functions performed during installation. Please see your local Dräger representative for details.

> **NOTE:** A *Care Unit* is a group of beds with the same hospital-assigned identification (i.e. CCU, ICU). The name of a Care Unit is unique within the hospital. A *Monitoring Unit* is a logical group of beds that share certain monitoring functions, such as alarm annunciations, recordings, and remote views. A Monitoring Unit can have more than one central station and span more than one Care Unit.

Basic Network Components

Bedside Monitor

Central Station

Simple Docking Station (mount only)

Infinity Docking Station (IDS)

IDS Power Supply

Communication Power Supply (CPS)

Interface Plate

R50 Recorder

Laser Printer

Access Points

Wireless LAN PC Card

Basic Bedside Setups

Bedside Setup with IDS

Access Point

Wireless Monitor with
Wireless LAN PC Card

Bedside Setup with CPS

Monitor with Interface Plate
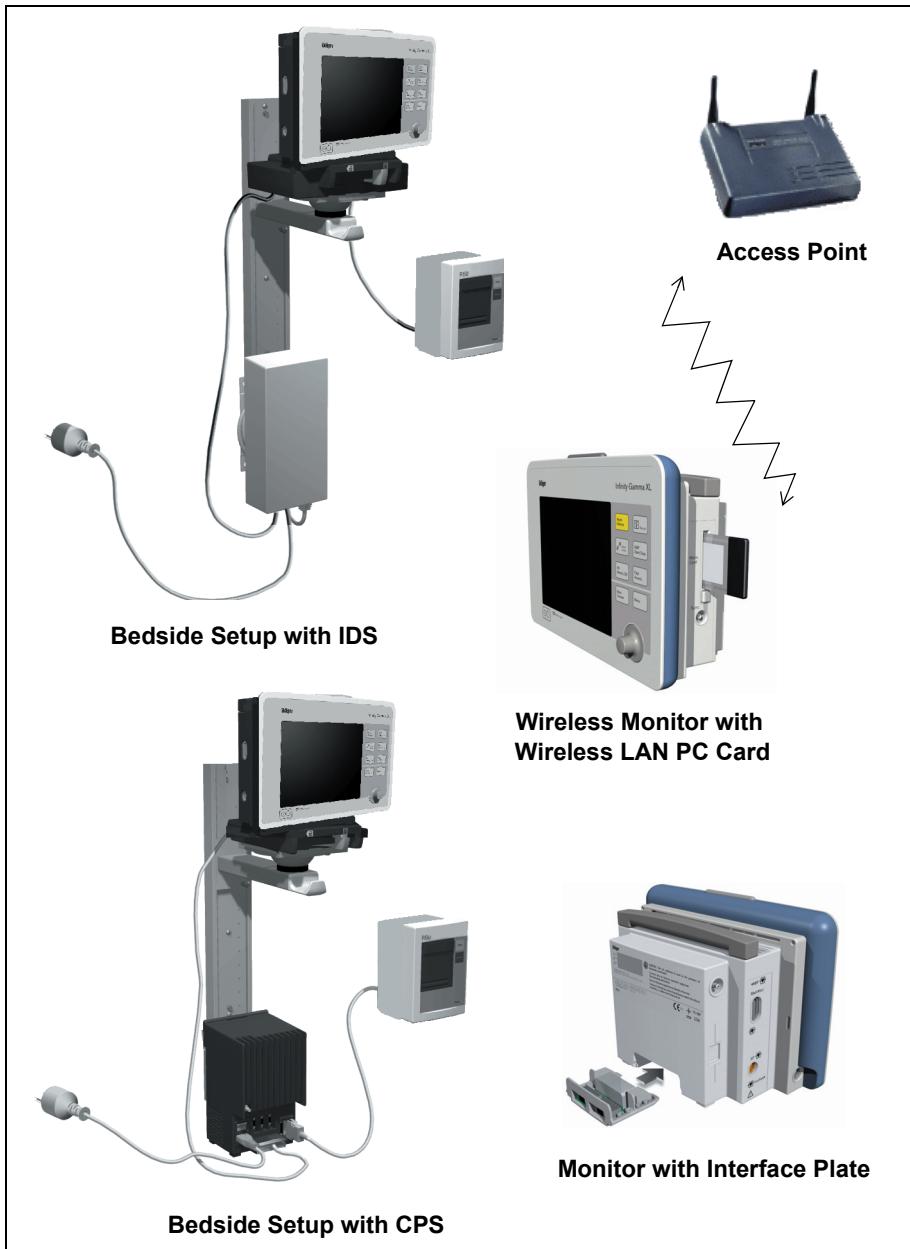
Network Operation

The bedside monitor operates in network mode when it is:

- Docked at a docking station,
- Equipped with a wireless PC card in a wireless network

Docking stations must be configured for network mode (versus standalone mode) by Dräger personnel during installation. Only Dräger personnel can modify these configurations, which define numerous network functions, including bedside labels, recorder labels, and the availability of remote control functions of the bedside monitor from other network devices.

Wireless monitors must be admitted to the network during installation. Once admitted, the user can then select care unit and bed label assignments according to where the wireless monitor is stationed (see the section *Wireless Network Configuration*, below). While a wireless monitor is docked at a docking station, it automatically accepts the docking station's care unit and bed label assignments.

If central monitoring is enabled at the bedside, you can assign the bedside to a display channel on the central station's screen. The monitor continuously sends the following information to the central station:

- Parameter values (including values reported as ***).
- Waveforms and their scales.
- Current bedside alarm limits and settings.
- Alarms and status messages.

At the central station, you can also call up the bedside's trend data and diagnostic log and you can store monitoring events (see the MULTIVIEW WORKSTATION User's Guide).

➤ **NOTES:**

■ The only configurations of the IDS/CPS that you can perform via the monitor's menus are the assignment of alarm groups and the selection of primary and secondary network recorders (see the chapters *Alarms and Messages* and *Recordings*).

■ If central monitoring is *dis*abled at the IDS/CPS,
-- you cannot turn the monitor's master speaker volume off,
-- no network offline messages appear at the bedside.

■ If central monitoring is *dis*abled at the IDS/CPS, you can continue to access the network recorder assigned to the IDS/CPS and alarm messages continue to be broadcast between devices in an alarm group.

■ Configuration of the monitor's network behavior is a password-protected Service function. For more information, consult with your biomedical personnel.

■ If a network connection cannot be established upon powerup, the monitor displays the message *Incompatible CPS* or *Network Error.*

Docking Station

The Infinity Docking Station (IDS) with companion DC power supply powers the monitor and provides connections for optional peripheral devices such as recorders, remote displays, or a nurse call system. The docking station serves as a secure mount for the monitor and allows quick mounting and dismounting in PICK AND GO transport situations.

While the monitor is docked at a docking station, its batteries are being charged. In case of a power failure, the monitor switches immediately to battery power without loss of data or monitoring settings.

➤ **NOTE:** The Infinity Docking Station (IDS), which offers full network connectivity and power, has replaced the simple Docking Station (mount only), which is used in conjunction with a Communication Power Supply (CPS). References to the simple Docking Station and CPS are included here for sites that still use them.
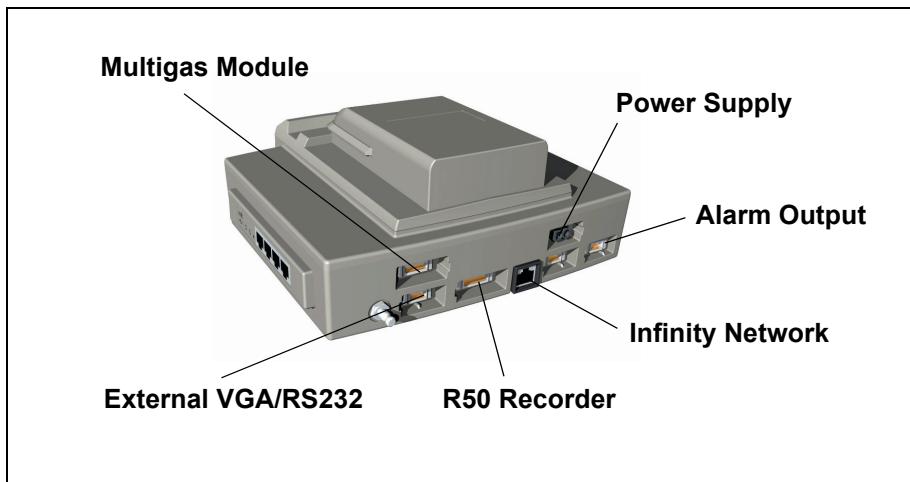
Infinity Docking Station (back panel)
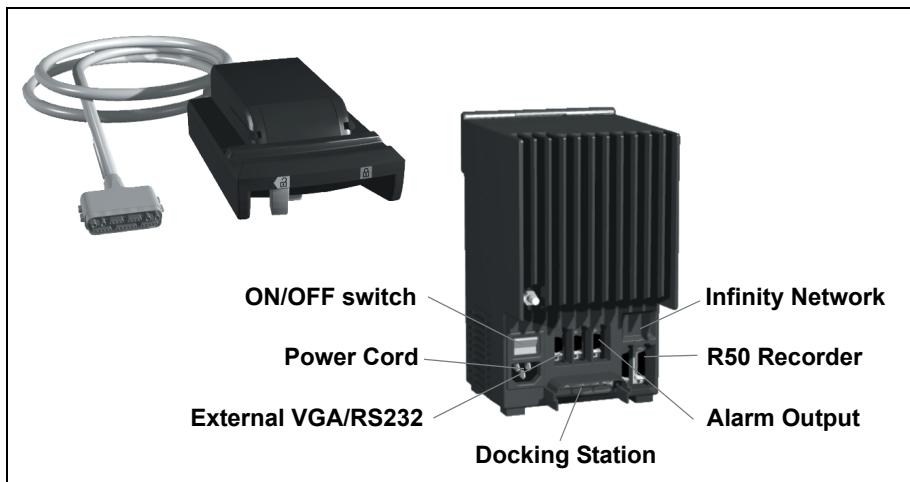
Mount-only Docking Station and CPS (back panel)

Docking and Undocking

STEPS: Docking the Monitor

1. Hold the monitor firmly by its handle and set it onto the Docking Station. Make sure the monitor is securely positioned and clicks into place. The Docking Station's locking lever does not move unless the monitor is seated properly.

2. Slide the locking lever to the right in order to engage the electrical connections and lock the monitor in place. The battery charging indicator on the front of the monitor lights up.

⚠ *CAUTION:* *To avoid dropping the monitor, do not let go of the monitor's handle until you have moved the locking lever as far to the right as possible, thereby locking the monitor in place.*

STEPS: Undocking the Monitor

1. Hold the monitor firmly by its handle. Slide the lever to the left to disengage the power supply. (The monitor automatically switches to battery power.)

2. Continue to move the lever to the left until it clicks. Tilt the monitor forward and lift it off the Docking Station.

When you remove the monitor from the Docking Station, patient data and settings remain stored in the monitor's memory. The central station blanks the monitor's data and displays the message *Bed Disconnected* (unless a wireless card is inserted -- see the section *Wireless Network Configuration*, below). Once the monitor returns to its Docking Station, it resumes sending patient data to the central station.

PICK AND GO versus Network Error

The network can distinguish between a network error and the intentional removal of a bedside monitor from its Docking Station.

If the monitor loses its connection with the network due to a technical problem, the network generates a network error message. When the monitor is removed from its Docking Station for transport, the central station displays a network status message (*Bed Disconnected*).

If the bedside monitor's speaker volume had been set to OFF during network operation, upon loss of communication with the network, it is automatically reset to 50% (default stand-alone level), or to 100% in case of an active alarm (network error message).

Wireless Network Configuration

The Infinity Gamma Series monitor can operate in a wireless network which allows the monitor to establish and maintain contact with the Infinity network and the central station without being docked at a Docking Station.

A wireless monitor transmits and receives data with the help of a wireless LAN PC card installed in the Memory Card slot on the monitor's side panel. The wireless card communicates with access points which are strategically placed within a monitoring unit in order to cover the desired transmission area.

```
                        ┌────────┐
                        │  MVWS  │
                        └────────┘
    ─────────────────────────┬──────────────────────
        │            ▽        │                │
   ┌─────────┐   ┌────────┐        ┌─────────┐
   │   IDS   │   │   AP   │        │   IDS   │
   └─────────┘   └────────┘        └─────────┘
   ┌─────────┐  ▽                  ┌─────────┐
   │ Bedside │                     │ Bedside │
   │ Monitor │                     │ Monitor │
   └─────────┘                     └─────────┘
      ┌──────────┐ ▽
      │ Wireless │
      │ Monitor  │
      └──────────┘

   MVWS = MultiView WorkStation (central station)
   IDS = Infinity Docking Station
   AP = Access Point
```
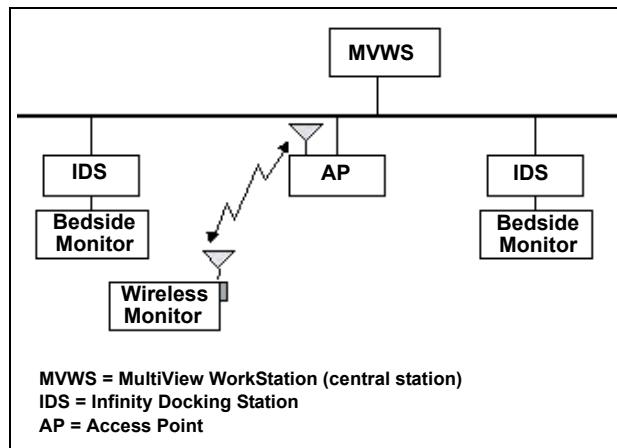
If a wireless monitor loses contact with all access points and wireless transmission is interrupted (i.e. you remove the wireless card or the monitor is out of range), the network generates an offline message and the monitor operates as a standalone device.

➤ **NOTE:** For detailed information about installation and configuration of wireless components, refer to the Dräger publication "Infinity Network Planning, Design, and Installation Handbook--*Wireless Extensions Supplement*."

A wireless network offers the following:

- **Seamless Patient Transport** — A wireless monitor continues to communicate with the Infinity network during Pick-and-Go transport situations and its data remains on the central display after leaving the bedside Docking Station.

- **Seamless Patient Relocation** — Patient and monitor can be moved to a different room or care unit without ever losing contact with the Infinity network.

- **Simplified Network Setup** — Wireless monitors can be networked without the need of docking stations or hard-wired hub connectors, which reduces the need for network cables within the hospital. (Note: Central station, access points, and recorders/printers *are* connected to the network by cable.)

🛑 **WARNING: Before operating the monitor in a wireless network configuration, please read the Network Safety Considerations at the end of this chapter.**

STEPS: Installing the Wireless Card

1. Turn the monitor off.

2. Facing the monitor, turn the card so that the flat side (back label) faces you.

3. Press the card firmly into the card slot until the slot's release button protrudes.
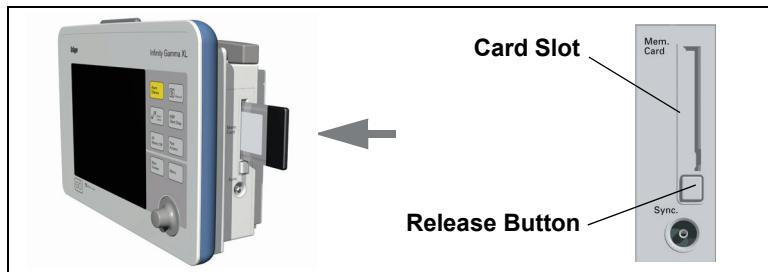
To remove the card, turn the monitor off and press the release button.

Wireless Network Operation

Care Unit and Bed Label Assignments

A wireless monitor receives care unit and bed label assignments in one of the following ways:

- Automatically when docking at a Docking Station.

- By manual entry via the Patient Admit menu.

When docking at a Docking Station, a wireless monitor automatically accepts the Docking Station's Care Unit and Bed Label assignments and communicates with the Infinity network via the Docking Station. When the monitor undocks, wireless card and access points take over communication between the monitor and the network.

When operating in a network without docking stations, you enter the Care Unit and Bed Label assignments in the Patient Admit menu (see the following steps).

➤ **NOTE:** Upon undocking, the monitor can either keep or give up the bed label assignment it received from the Docking Station, depending on the network setup performed by Service personnel during installation.

- If the monitor has been configured to keep the Docking Station's bed label upon undocking, the monitor retains the bed label as well as its display position at the central station.

- If the monitor has been configured to give up the Docking Station's bed label upon undocking, it either reverts back to a previously entered bed label, or the user must manually enter a new care unit and bed label via the Patient Admit menu. If the bed label entered is already in use, the monitor displays an error message.

➤ **NOTE:** After turning a wireless monitor on, it receives a list of available care units and bed labels from the MULTIVIEW WORKSTATION. If this list is not immediately available in the monitor's Patient Admit menu, wait until the list has been fully transmitted.

STEPS: Selecting Care Unit and Bed Label

1. Undock the monitor, if docked.

2. Press the **Menu** fixed key.

3. Click on **Admit/Discharge**.

4. Click on **Patient Admit**.
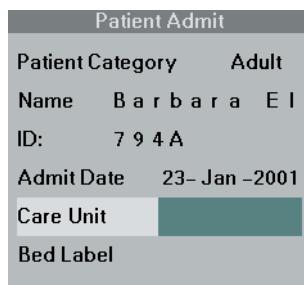
5. Click on **Care Unit**.

6. Dial in the desired care unit from the list of available choices and click the knob.

7. Click on **Bed Label**.

8. Dial in the desired bed label from the list of available choices and click the knob.

> **NOTES:**
>
> ■ You can enter a care unit and bed label only after undocking the monitor. While the monitor is docked or operating as a stand-alone device, these menu selections are not available.
>
> ■ Upon undocking, wait a few moments until the monitor has received a list of available care units from the network.
>
> ■ Always select the care unit before selecting the bed label, because the Bed Label menu only lists beds located in the selected care unit.
>
> ■ The overall list of available care units and bed labels is established during network installation. If you cannot find the desired care unit or bed label as a menu choice, contact your Biomed or DrägerService.

Central Display

The central station identifies wireless monitors by a transmission icon on the central display. Upon undocking, the bed's central display channel (viewport) remains assigned to the wireless monitor. If another monitor docks on the same Docking Station which is still associated with the wireless monitor, the new monitor receives the same bed label from the Docking Station, but does not replace the wireless monitor in the viewport of the central station. In order to view the new monitor on the central display, the user has to assign a different display channel to the new monitor via the central station's Assign Bed menu.

➤

NOTES:

■ Patient name and ID continuously identify the patient on central displays, recordings, and data bases, whether the monitor is in transport or docked.

■ If a wireless monitor is transmitting to a central station but has not been assigned a viewport at that station, the message *Not monitored by central* appears in the monitor's message area.

Patient Relocation

You can move monitor and patient to a different room and care unit by simply docking the monitor at the new location. Alternatively you can select care unit and bed label of the intended new location via the Patient Admit menu (see the section *Selecting Care Unit and Bed Label*).

During transport, the wireless monitor continues to communicate with its assigned central station via the access points. Upon docking at the new location, the monitor accepts the new Docking Station's care unit and bed label assignments as well as its display position on the central station's cluster screen.

If you change central stations, that is, move the monitor to a room that is monitored by a different central station, the original central station blanks the monitor's data and displays the message *Bed Disconnected*.

➤

NOTE: During the transition between wireless and wired network operation, the network may generate an error tone, if the transition takes more than a few seconds. There is no loss of data and normal network operation continues, as soon as the MULTIVIEW WORKSTATION has recognized the monitor's new connection status.

Network Safety Considerations

When operating the monitor in a wireless network, please observe the following:

- Before using the wireless monitoring equipment, read the instructions and safety warnings supplied by the wireless equipment manufacturer.

- While the unit is transmitting or receiving signals, do not hold the transmitting/receiving unit close to exposed body parts, especially the face or eyes. The antenna/wireless card should be at least 2" (5 cm) away from the body.

- Operation of the wireless network relies on uninterrupted signal transmission between the transmitting and receiving components of the network. When using the wireless network, be aware that

    -- certain structural limitations within the hospital building may interfere with signal transmission,

    -- other devices emitting radio frequencies, such as leaky microwave ovens or warmers, may interfere with signal transmission,

    -- the frequencies emitted by the device may interfere with the operation of other wireless operated medical equipment.

- The installation of wireless equipment must be performed by qualified Service technicians. Any changes or modifications to the equipment not expressly approved by the equipment manufacturer may result in equipment malfunction or damage.

- In order to isolate the Dräger wireless Infinity network from other 802.11b operators within the hospital, the SSID of each set of access points has to be unique. Access points are not considered medical equipment and should be kept out of the patient's vicinity. For further information, consult the manufacturer's documentation or the Dräger publication "Infinity Network Planning, Design, and Installation Handbook-- Wireless Extensions Supplement."

Alarm and Status Messages

When the monitor is connected to the network, network messages alert you of network operating conditions. Some messages display only once (i.e., *Remote Limit Change*), while others appear alternately until the condition has been resolved (i.e. alarm messages such as *BED 200:ECG Leads Off*). A network alarm error creates an error tone, while status messages do not.

Screen Message	Condition
Selected Bed Label Currently in Use	A wireless monitor undocks, but its assigned bed label is already in use.
	The user selects a care unit and bed label for a wireless monitor, but the bed label is already in use.
Duplicate Address	Another network device has been programmed with a conflicting identification. The bedside monitor is treated as being offline.
Incompatible CPS	The monitor is connected to a SIRENET CPS, not an Infinity IDS/CPS.
	The monitor is connected to an Infinity IDS/CPS, but the software is incompatible. Call your service support.
Network Alarm Error	An interruption in the network communication has been detected while an alarm is active; the speaker volume at the bedside has been increased to its maximum level.
Not Monitored by Central	A wireless monitor is transmitting to a central station, but is not assigned a viewport on the central station's cluster screen.
Offline	The monitor is not connected to the network or the network is not configured correctly.
	A wireless monitor has traveled out of range.
	The wireless card is not installed properly.
Remote Limit Change	Alarm settings (on/off, alarm limits, alarm recording, including ARR and ST) have been changed at the MULTI-VIEW WORKSTATION.
Remote Relearn	Relearning of the patient's ECG or respiration pattern has been initiated at the MULTIVIEW WORKSTATION.
Silence by Remote	Alarm has been silenced at the MULTIVIEW WORKSTATION.

4 Admission/Discharge/ Transfer

Overview

The Patient Admit menu allows you to enter and edit a patient's personal data (name, ID, admit date) and select the patient category. If your monitor is operating in a monitoring network, you can also review or change the monitor's care unit and bed label assignments.

In network mode, you can admit patients at the bedside monitor or at the central station. The central station offers more data entry fields (such as birth date, height, weight) which the Infinity Gamma Series monitor does not display but which can be reviewed or edited at the central station (see the user's guide to the MULTIVIEW WORKSTATION).

You can transfer patient data and monitoring setups between monitors over the Infinity network or with the help of a data card. If you discharge a patient, the monitor deletes the patient's monitoring data.

Patient Admission

When you turn on the monitor or exit the standby mode, the monitor displays a *New Patient?* prompt to assure that previously stored patient data is deleted before you monitor a new patient.

To start monitoring a new patient, press the rotary knob and click on **New Patient? YES**. The monitor deletes all previously stored monitoring data, including trends, events, and recordings.

To continue monitoring a previous patient, press the rotary knob and click on **New Patient? NO**. The monitor retains previously stored monitoring data.
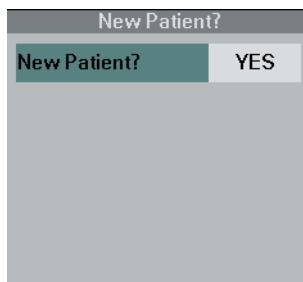
➤ **NOTE:** After a power-cycle or upon leaving standby, all alarms are turned off for three minutes or until you press the All Alarms Off fixed key.

Admit Menu

STEPS: Calling up the Patient Admit Menu

1. Press the **Menu** fixed key.

2. Click on **Admit/Discharge**.

3. Click on **Patient Admit**.

Patient Admit	
Patient Category	Adult
Name	
ID:	
Admit Date	– –
Care Unit	
Bed Label	
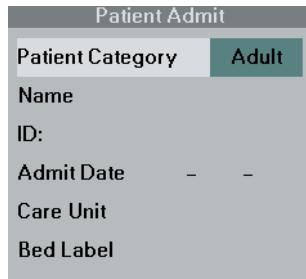
➤   **NOTE:** You cannot enter selections for Care Unit and Bed Label when the monitor is docked at a Docking Station or operating as a stand-alone device. For information on selecting the care unit and bed label, see the chapter *Network Applications*.

Patient Category

➤ **NOTE:** The currently selected patient category is indicated between the first and second waveform channels next to the parameter boxes.

STEPS: Selecting the Patient Category

1. Call up the Patient Admit menu (Menu > Admit/Discharge > Patient Admit, see above).

2. Click on **Patient Category**.

Patient Admit	
Patient Category	Adult
Name	B a r b a r a E l
ID:	7 9 4 A
Admit Date	23– Jan –2001
Care Unit	
Bed Label	
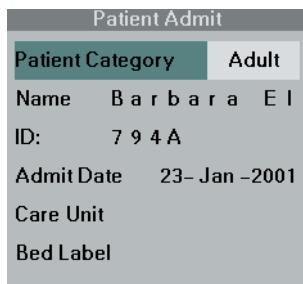
3. Dial in the desired patient category (Adult, Pediatric, Neonate) and click the knob.

When you change the patient category, the monitor:

■ Clears all current alarms, including their messages.

■ Stops any NBP measurement in progress.

■ Deletes stored trend data, events, and recordings.

■ Returns alarm limits to their category-specific default settings (see appendix *Default Settings and Biomedical Support*).

■ Returns waveform display scales (sizes) to their category-specific default settings (see appendix *Default Settings and Biomedical Support*).

■ Sets the display range for trend values according to the selected patient category (see *Trends* chapter).

When switching to the neonatal mode, the monitor also:

- Disables arrhythmia detection and clears all arrhythmia labels from the screen.

- Disables pacemaker detection.

- Disables ST Segment analysis (if option is available).

- Allows viewing of an Oxy-Cardiorespirogram (if option is available).

Name and ID

STEPS: Entering Name and ID

1. Call up the Patient Admit menu (Menu > Admit/Discharge > Patient Admit, see above).

2. Click on **Name**. A white entry field appears for the first character of the name.

3. Click the knob, dial in the first character (A-Z, a-z, 0-9) and click the knob again.

    | Name | B | ↑ |

4. Turn the knob clockwise to scroll to the next entry field and click. Dial in the second character and click. If you need to separate words (i.e. first name from last name), click on a blank space.

5. Enter the remaining characters accordingly.

    The Admit Menu can display up
    to 9 characters at a time, but you
    can enter additional characters

    | Name | r b a r a   E | ↑ |

    (up to 25 for the name and up to 12 for the ID) by *scrolling
    past* the up arrow (↑) at the end of the line, thereby shifting
    the entry to the left. Once entered, the full name does appear
    in the name field above the top waveform channel, on central
    station displays, and on recordings.

    To make changes to your entry,
    you can dial in and click on the
    left or right arrow (← and →).

    | Name | B a r b a r ← E | ↑ |

    Clicking on the left arrow deletes the character and moves the
    entry one space to the left; clicking on the right arrow moves
    the character and the entry one space to the right.

6. To exit the name entry line, click
    on the up arrow (↑).

    | Name | a   E l l i o t t | ↑ |

7. Enter the patient ID accordingly.
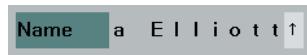
Admit Date

STEPS: Entering the Admit Date

1. Call up the Patient Admit menu (Menu > Admit/Discharge > Patient Admit, see above).

2. Click on **Admit Date**. The monitor automatically enters the current date.

Patient Admit	
Patient Category	Adult
Name	B a r b a r a E l
ID:	7 9 4 A
Admit Date	23– Jan –2001
Care Unit	
Bed Label	
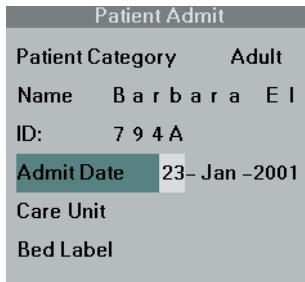
3. If necessary, edit the date by clicking on the day, month, or year entry fields and dialing in the desired date.

4. To exit the date entry line, simply scroll off to the left or right.

Patient Discharge

You can discharge a patient only at the bedside, not at the central station. Upon discharge, the monitor deletes all previously stored monitoring data (such as QRS reference complexes, trends, events, and recordings), and it returns to default or previously stored monitoring settings (see the chapter *Default Settings and Biomedical Support*).

STEPS: Discharging a Patient

1. Press the **Menu** fixed key.

2. Click on **Admit/Discharge**.

3. Click on **Discharge**.

Discharge	
Discharge Patient?	YES
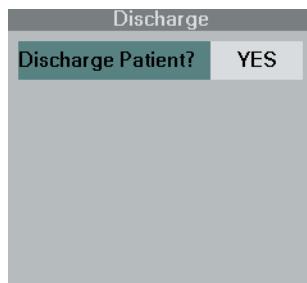
4. Click on **Discharge Patient? YES.**

When you discharge a patient at the bedside, the central station deletes the bedside's data from the bed view and displays a *Discharge* banner for this bed.

➤ **NOTE:** You can also discharge a patient from the **New Patient?** prompt upon leaving the Standby mode. In this case, however, the patient's name remains displayed at the central station until you admit a new patient.

Data Transfer

You can transfer patient data between monitors in the following ways:

- By sending data to a different monitor over the Infinity network.

- By copying data onto a memory card and then loading it into a different monitor (stand-alone option).

The transfer of patient data involves a source monitor and a destination monitor. The **source** monitor is the unit from which the data is transferred. The **destination** monitor is the unit receiving the data. Transferred patient data includes the patient's name, ID, admit date, patient category, as well as stored trends.

➤ **NOTES:**

- When a data transfer takes place between two monitors whose selected units of measure do not match (i.e.°C/°F, mmHg/kPa, mm/mV), the destination monitor adopts the units of measure that were selected at the source monitor.

- When a data transfer takes place between two monitors with different enabled software options, the destination monitor accepts data only for those options which are enabled at the destination monitor (i.e. ST, $etCO_2$), and ignores the rest.

- If the Respiration or the $etCO_2$ waveform was displayed at the source monitor, but the same waveform is not selected for display at the destination monitor (see selection *Show Rsp/Show etCO_2* in the *Respiration* chapter), then the data for this parameter cannot be accepted by the destination monitor. To transfer this data, first select the desired waveform display (Rsp or $etCO_2$) at the destination monitor.

- For data transfer between Gamma Series monitors, lead V+ will be transferred only if both the source and the destination monitors are using a 6-lead ECG cable. Use of a smaller lead set cable will only transfer data corresponding to the smaller lead set. The remaining data will be lost.

- Stored events cannot be transferred.

Transfer Across the Network

➤ **NOTE:** Before data transfer can take place over the network, the source monitor must be placed into Standby mode.

STEPS: Transfer Across the Network

At the **source** monitor:

1. Place the source monitor into Standby.

At the **destination** monitor:

1. Press the **Menu** fixed key.

2. Click on **Admit/Discharge**.

3. Click on **Transfer**. The Transfer menu opens.
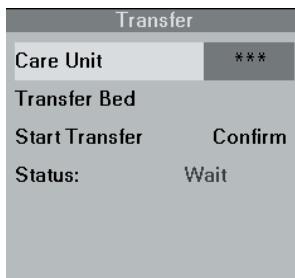
4. Click on **Care Unit**. Selection ******* is the default and automatically selects all care units. If you want to narrow your search for the transfer bed and select the specific care unit in which the **source** monitor is located, dial in the appropriate care unit from the available choices in the menu and click the knob.

➤ **NOTE:** The menu shows only those care units which have at least one bedside monitor in Standby mode.

5. Click on **Transfer Bed**.

6. Select the bed label of the **source** monitor and click the knob.

➤   **NOTES:**

- The Transfer Bed menu displays all networked beds in the selected care unit that are currently in Standby mode.

- You must click on a bed label, even if there is only one available bed listed in the transfer menu; if you do not select a bed, the transfer cannot take place.

- If a previous patient had not been discharged at the destination monitor before data transfer, the discharge takes place automatically during transfer and all previous patient data is deleted.

7. Click on **Start Transfer**.

8. Click on **Confirm** to start the transfer.

During transfer, the Transfer menu displays the status message *Transferring data.* Once the transfer is complete, the patient is automatically discharged from the source monitor and admitted to the destination monitor.

If the transfer is interrupted or unsuccessful, the destination monitor displays a transfer error message. In this case, the source monitor retains its data and you can attempt the transfer again.

Transfer with a Data Memory PC Card

The transfer of patient data with a memory card involves copying data from the source monitor onto a card and then from the card into the destination monitor.

STOP

WARNING: Your monitor may not be equipped with ESD protection for the memory card slot. Refer to the Service manual or contact your Biomed for further details.

NOTES:

■ Previous monitor hardware versions may not support data transfer with the memory card. If the *Copy to Card* menu does not appear on the Main Menu when you select Admit/Discharge > Copy Data, refer to the Service manual or contact your Biomed.

■ You can copy patient data only to an SRAM/PCMCIA card.

Copy To Card	
Name:	Barbara Elliott
ID:	794A
Start Transfer	Confirm
Status:	Ready

The source monitor copies patient admit data as well as stored trends onto the card. To assure that the copied data is correctly identified with the patient, you must have entered a patient name or ID for the source monitor before the data transfer can take place. If necessary, enter the patient's name or ID before proceeding with the data transfer (see the section *Name and ID*, above).

When copying data to a memory card, the source monitor erases all information previously stored on the card. Similarly, copying data from a card to a monitor overwrites (not appends) all data currently stored in the destination monitor. At the end of a successful data transfer from the card, the destination monitor erases all contents from the card.

NOTE: While the monitor is operating in the wireless network, no data transfer via the memory card can take place, because the wireless card occupies the memory card slot.

STEPS: Copy to Card

⚠️ **CAUTION:** *Before a copy, the monitor erases all contents of the card.*

1. Insert a memory card into the memory card slot on the right side of the source monitor.

2. Press the **Menu** fixed key.

3. Click on **Admit/Discharge**.

4. Click on **Copy Data**.
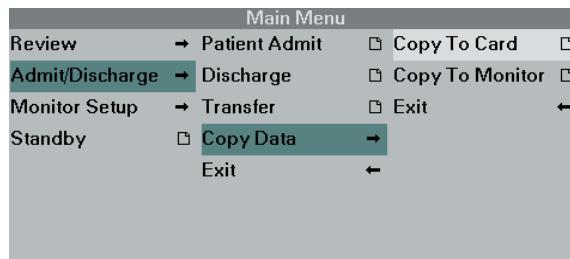
5. Click on **Copy to Card**. The monitor displays the *Copy to Card* menu.

6. When the message '*Ready*' appears in the Status field, click on **Start Transfer: Confirm** (or **Cancel** to cancel the transfer).

During data transfer, the monitor displays the message '*Wait*' in the Status field or an error message, if copying cannot be initiated (i.e. card is not fully inserted). If the copy was successful, the monitor time stamps the card and displays the message *'Card data copy complete'*; otherwise, the monitor displays the error message *'Card data copy unsuccessful'*. Using an invalid memory card (i.e., a software card) produces the message *'Card Contents Invalid'* together with an error tone, and copy to card is not possible.

STEPS: Copy to Monitor

⚠️ *CAUTIONS:*

- *Copying data from a card to a monitor overwrites (not appends) all data currently stored in the monitor.*

- *After it has copied all the data from a card, the monitor erases data stored on the card.*

1. Insert the memory card into the memory card slot on the right side of the destination monitor.

2. Press the **Menu** fixed key.

3. Click on **Admit/Discharge**.

Main Menu	
Review → Patient Admit	🗋 Copy To Card 🗋
Admit/Discharge → Discharge	🗋 Copy To Monitor 🗋
Monitor Setup → Transfer	🗋 Exit ←
Standby 🗋 Copy Data →	
Exit ←	
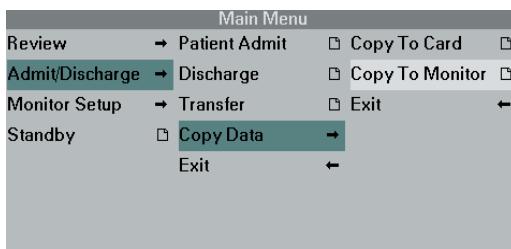
4. Click on **Copy Data**.

5. Click on **Copy to Monitor**. The Copy to Monitor menu appears with the patient **Name**, **ID** and **Status** in the corresponding fields.

Copy To Monitor

Name:	Barbara Elliott
ID:	794A
Offset, minutes:	0
Start Transfer	Confirm
Status:	Ready

➤ **NOTE:** The **Offset, minutes** field shows how many minutes have passed since the patient data was written on the card. The field shows a negative value if the card was written earlier than the current time on the destination monitor. The field shows a positive value if the time stored on the card is ahead of the time displayed on the destination monitor.

6. When the message *'Ready'* appears in the Status field, click on **Start Transfer**: **Confirm** (or **Cancel** to cancel the transfer).

At the end of a successful copy, the monitor displays the message *'Card data copy complete.'* If it was unable to copy data from the card, the monitor displays the error message *'Card data copy unsuccessful.'* If the data on the card is older than 24 hours, the error message *'No data to copy for last 24 hours'* alerts the user of the invalid procedure.

5 Alarms and Messages

Alarm Grades

The monitor annunciates both audible and visual alarms to alert you to significant changes in the patient's condition and to malfunctions of the equipment that may affect the accuracy of measurements.

All alarms fall under one of three alarm grades:

■ Life-threatening.

■ Serious.

■ Advisory.

If the monitor detects more than one alarm at a time, it annunciates the alarm with the alarm highest priority.

Life-Threatening Alarms

A life-threatening has the highest alarm priority. The monitor triggers life-threatening alarms for **asystole**, **ventricular fibrillation**, **ventricular tachycardia**, and **bradycardia** (bradycardia in neonatal mode only).

A life-threatening alarm has the following characteristics:

■ The HR parameter box blinks and appears red.

■ The monitor emits a continuous warble tone.

■ The monitor displays the alarm cause in both the parameter box and the message area.

■ The alarm continues until you press the **Alarm Silence** fixed key, the **All Alarms OFF** fixed key, or turn that parameter's alarm off (see the section *Alarm Settings*, below).

WARNING: If HR alarms and arrhythmia detection are turned off, the monitor does not alarm for asystole and ventricular fibrillation.

Serious Alarms

A serious alarm has the second highest priority. It alerts you to significant changes in the patient's condition other than life-threatening events as defined in the preceding section. For example, if a monitored parameter falls below the selected alarm limits, the monitor triggers a serious alarm. An unrecognized physiological condition, as when a detected parameter is outside the monitor's measuring range, triggers a serious alarm also.

➤ **NOTE:** Apnea events trigger a serious alarm in all monitoring modes.

A serious alarm has the following characteristics:

- The parameter box blinks and appears yellow.
- The monitor produces two short tones continuously.
- The monitor displays the alarm cause in both the parameter box and the message area.
- The monitor stops the alarm automatically when the condition ceases to exist.
- The monitor stops the alarm when a new alarm of equal or higher grade is triggered.

Advisory Alarms

An advisory alarms has the lowest priority. It can result from one of three conditions:

■ When the monitor cannot produce a parameter value due to a technical problem (e.g. a lead-off condition).

■ A patient cable or accessory failure (e.g. a blocked line in the pressure cuff).

■ The presence of persistent artifact.

An advisory alarm has the following characteristics:

■ The parameter box blinks and appears white.

■ The monitor produces a single tone followed by a 1½ second pause, continuously.

■ The monitor displays the alarm cause in both the parameter box and the message area.

■ The monitor stops the alarm automatically when the condition ceases to exist.

■ The monitor stops the alarm when a new alarm of equal or higher grade is triggered.

Alarm Settings

On the Alarm Limits table you can:

- Set alarm limits.
- Turn parameter alarms on or off.
- Turn alarm recordings on or off.

To call up the Alarm Limits table, press the **Alarm Limits** fixed key.

Alarm Limits					
▼ ▲	Upper	AutoSet	Lower	Alarm	Record
HR	120		45	ON	Record
PVC			20	ON	Store
PLS	120		45	ON	Str/Rec
SpO₂	100		90	ON	Record
T	39.0		34.0	🔕	Store
STII	1.0		−1.0	🔕	OFF
STV	1.0		−1.0	🔕	OFF

The Alarm Limits table has several pages with additional parameters. To call up additional pages and parameters:

- Press the **Alarm Limits** fixed key again, or
- Click on the up or down arrow in the upper left-hand corner of the table.

➤ **NOTE:** Set arrhythmia alarms and alarm recordings on the Arrhythmia Setup table (see the chapter *Arrhythmia*).

Setting Alarm Limits

You can set alarm limits for each parameter individually, or you can use the AutoSet function to set alarm limits for all parameters at once based on the current parameter values.

STEPS: Setting alarm limits individually

1. Press the **Alarm Limits** fixed key.

2. Scroll to the **Upper** column for the desired parameter and click the knob.

Upper	AutoSet	Lower
120		45
		20
120		45
100		90

3. Dial in the desired upper limit and click the knob.

4. Scroll to the **Lower** column and click the knob.

5. Dial in the desired lower limit and click the knob.

STEPS: Using the AutoSet function

1. Press the **Alarm Limits** fixed key.

2. Scroll to **AutoSet**. The column AutoSet shows the upper and lower limits that are automatically calculated for each parameter based on current parameter values.

Upper	AutoSet		Lower
144	144	102	102
96	96	68	68
120	120	85	85
24	24	17	17

3. To accept these limits for all parameters, click on **AutoSet**. The automatically calculated limits are written into the Upper and Lower columns.

➤

NOTES:

- The AutoSet function sets alarm limits for all parameters at once, even for those not displayed on the current page of the Alarm Limits table. Exception: There is no AutoSet function for PVC.

- If a parameter value is not currently available (e.g. during a lead-off condition), the monitor does not adjust the alarm limit for that parameter when you click on AutoSet.

- After using the AutoSet function, you can change individual alarm limits at any time.

- Due to slight rounding differences in values, the alarm limits display for kPa values at the central station does not match the alarm limits display for kPa values at the Infinity Gamma Series monitor.

For the AutoSet function, the monitor calculates alarm limits as a percentage of the current parameter values as follows:

Parameter	Upper Limit	Lower Limit
SpO$_2$	fixed at 100%*	-5%
HR, PLS, Rsp, etCO$_2$, iCO$_2$, RRc, GP1, GP2, and NBP	+20%	-15%
Scio Multigas	+10%	-15%
Temperature	+7%	-7%
ST	+2.0	-2.0

*For neonatal monitoring mode, the Upper Limit Adjustment is fixed at 95%. Higher adjustments must be made manually.

Turning Parameter Alarms On/Off

The monitor annunciates alarms only for parameters whose alarm is turned on. You can turn alarms on or off for each parameter individually.

When you turn a parameter alarm off, the monitor displays a crossed bell icon in the corresponding parameter box. 🔕

STEPS: Turning Parameter Alarms On or Off

1. Press the **Alarm Limits** fixed key.

2. Scroll to the **Alarm** column of the desired parameter and click the knob.

Upper	AutoSet	Lower	Alarm	Record
120		45	ON	Record
		20	🔕	Store
120		45	ON	Str/Rec
100		90	ON	Record

3. Dial in the desired setting and click the knob.

> **STOP**

WARNING: If HR alarms and arrhythmia detection are turned off, the monitor does not alarm for asystole and ventricular fibrillation. If Respiration alarms are off, the monitor does not alarm for apnea events.

> ➤

NOTES:

- ■ In French-NFC mode (a Service setting), either the HR or the SpO_2 alarm must be on. If you turn one of these alarms off, the monitor automatically turns the other alarm on.

- ■ If the monitor is networked to a MULTIVIEW WORKSTATION and the patient has been admitted to the Event Disclosure application, the MULTIVIEW WORKSTATION documents any alarm that is turned on. For more information, refer to the MULTIVIEW WORKSTATION User's Guide.

Turning Alarm Recordings On/Off

The monitor prints and/or stores alarm recordings automatically, if the Record and/or Store function is enabled on the Alarm Limits table.

STEPS: Turning Alarm Recordings/Storage On or Off

1. Press the **Alarm Limits** fixed key.

2. Scroll to the Record column of the desired parameter and click the knob.

Upper	AutoSet	Lower	Alarm	Record
120		45	ON	Record
		20	ON	Store
120		45	ON	Str/Rec
100		90	ON	OFF

3. Dial in the desired recording/storage setting and click the knob.

See the *Recordings* chapter for a description of alarm recordings, stored recordings, and the Event Recall screen.

External Alarm Lights

A set of alarm lights on top of the monitor blink red for life-threatening alarms and yellow for serious alarms, if the external alarm light function is enabled in the Monitor Setup menu (default setting is ON). If more than one alarm occurs at the same time, the lights blink for the alarm with the highest alarm grade. If the user silences the alarm, the alarm lights remain lit without flashing. If the user turns all alarms off, the alarm lights are turned off as well.

For important information about external alarm lights, see the chapter *Monitor Setup*.

Alarm Validation

The alarm validation feature minimizes nuisance alarms for transient conditions. When a parameter value falls below or rises above its current alarm limits, the monitor waits a predetermined time before triggering the alarm. If the parameter value returns to within the upper or lower alarm limit before the end of the alarm validation period, the monitor does not trigger the alarm.

The alarm validation period is part of the software (see table below) and cannot be modified. The monitor triggers the alarm at the end of the validation period. Parameters have the following alarm validation periods:

Parameter-Specific Alarm Validation Periods		
Parameter	**Upper Limit (in seconds)**	**Lower Limit (in seconds)**
ECG/Heart rate (HR)	2	0
Pulse rate (PLS)	4	10
ST Segment Analysis*	60	60
Respiration rate (Rsp)	8	10
Arterial Oxygen Saturation (SpO$_2$)	4	10
etCO$_2$*, iCO$_2$*, T, PVC, Arrhythmia Events	0	0
Scio Multigas*	0	0
RRc*	8	10
Invasive blood pressure (ART, PA, CVP, ICP, GP1, GP2*)	4	4
Non-invasive blood pressure (NBP)	0	0
*Available only if option is enabled		

Silencing Alarms

The monitor offers two fixed keys to silence alarms:

■ **Alarm Silence**.

■ **All Alarms OFF**.

Alarm Silence Key

Press the **Alarm Silence** fixed key to silence active alarms. The silence period lasts 1 minute unless a new alarm occurs.

During the silence period while an alarm condition persists:

■ The parameter box stops blinking but remains highlighted.

■ The message remains displayed on the bottom of the screen.

If the patient's condition has not changed after one minute:

■ The monitor sounds the same alarm again.

■ You can press the **Alarm Silence** fixed key again to silence the alarm for an additional minute.

If the monitor detects a new alarm condition during the silence period:

■ The monitor annunciates the new alarm immediately, delivering both audible and visual alarm indicators.

■ The new parameter box blinks while the parameter box of the previously silenced alarm remains highlighted.

The new message appears at the bottom of the screen and then alternates with the message for the previously silenced alarm.

If the monitor detects two or more new alarm conditions during the silence period:

- The monitor delivers the audible signal for the newest alarm with the highest priority.

- Both alarming parameter boxes blink.

- The message for both alarms is displayed alternately in the message area of the screen.

All Alarms OFF Key

Press the **All Alarms OFF** fixed key to suspend all alarm indications for a 3 minutes. During an alarm suspension, the message banner *All Alarms OFF* appears on top of the waveform area.

➤ **NOTE:** When starting the monitor, coming out of Standby, or answering "Yes" to the New Patient prompt, alarms are suspended for 3 minutes or until you press the All Alarms OFF key to deactivate the alarm suspension.

During the 3-minute alarm suspension:

- All currently annunciated alarm tones cease.

- All parameter boxes return to normal colors.

- All alarm messages are removed from the message area at the bottom of the display.

- All new alarms are blocked.

- Currently activated alarms, including latched alarms, are acknowledged.

- When on the network, the message banner *All Alarms OFF* appears in the bedside's remote display on the MULTIVIEW WORKSTATION and in the ClusterView.

STOP **WARNING: During alarm suspensions, never leave a patient unattended, and always re-enable the alarms as soon as possible.**

Assigning Alarm Groups

If a monitor is part of the Infinity network, alarm messages from other networked monitors appear in the message area at the bottom of the screen (i.e. *BED 20: ECG Leads Off*). In order to limit the number of messages from remote beds, you can group beds into separate alarm groups so that only messages from monitors within the same alarm group are shared. If you do not want to display any remote alarm message at a particular bed, place that bed in its own alarm group.

⚠️ *CAUTION: The user must confirm at each individual bedside that the monitor is assigned to the desired alarm group.*

STEPS: Assigning Alarm Groups

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

Main Menu		
Review	➜ Main Screen	▯
Admit/Discharge	➜ Monitor Options	➜
Monitor Setup	➜ Trend Setup	▯
Standby	▯ Recordings	▯
	Biomed	➜
	Alarm Groups	▯
	Exit	⬅

3. Click on **Alarm Groups**.
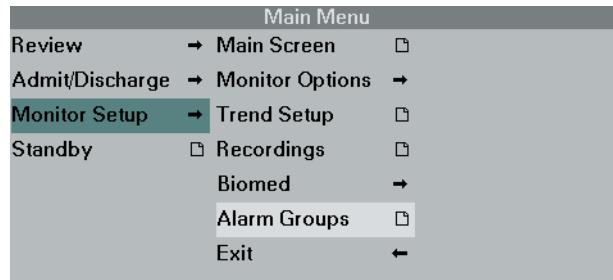
Alarm Groups	
Alarm Group	4

4. Click the knob, dial in the number of the desired alarm group, and click the knob again.

Central Alarms

If the bed appears on the central station's display, the central station announces all bedside alarms. The alarm grade (life-threatening, serious, advisory) is determined by the bedside's setting. If the central station fails to indicate a bedside alarm within 10 seconds, the bedside monitor reports a network alarm error and alarms sound at their highest volume at the bedside. Once the network error is corrected, the bedside's master volume returns to the last user setting.

➤ **NOTES:**

■ When the monitor is connected to the Infinity network, you can turn the master speaker volume off at the bedside. If the monitor is operating as a stand-alone device, you cannot turn the speaker volume off at the bedside (also see the *Monitor Setup* chapter).

■ During a network alarm error, the master speaker volume at the bedside can be lowered via the Monitor Setup menu. The network error message remains on the screen until the error condition is resolved.

From the central station, you can remotely:

■ Set alarm limits.

■ Turn parameter alarms On or Off.

■ Silence active alarms.

■ Turn alarm recordings On or Off.

Changes made to the alarm limits at the central station take effect immediately at the bedside monitor. For more information, see the MULTIVIEW WORKSTATION's user's guide.

Alarms in OR Mode

When you select the OR mode (see the chapter *Multigas*), the monitor's alarm behavior for some alarms changes in order to avoid nuisance alarms during surgical procedures. In OR mode, the following applies:

- All ECG Lead Off conditions as well as the sensor application errors *SpO2 Transparent* and *SpO2 Light Blocked* cause one-time advisory alarm indications only.

- A prolonged RRc apnea condition causes an escalation of alarm indications. When the first apnea interval expires, the monitor issues a one-time *advisory* alarm. If the RRc apnea condition persists through 3 apnea intervals, the monitor issues a one-time *serious* alarm. If the RRc apnea condition persists through 6 apnea intervals, the monitor issues a one-time *life-threatening* alarm. (The length of the apnea interval depends on the selected RRc Apnea Time, 10 to 30 seconds; see the chapter *End-Tidal CO_2*.)

Messages

The monitor displays the following types of messages:

- Alarm messages to alert you to a physiological condition (e.g., *Asystole*).

- Status messages to alert you to faults and their causes (e.g., *RA Lead Off*) or to follow the work-in-progress of your monitor (e.g., *Alarm Recording Started*).

- Diagnostic messages to alert you to hardware and software conditions (e.g., *Low Battery Reset*).

- Network messages (including Alarm Group messages) to alert you to network operating conditions (also see the chapter *Network Applications*).

The monitor displays alarm messages according to their alarm grade on a red, yellow or white background in the message area (e.g., *Asystole*) and in the parameter box (e.g., *ASY)*.

The monitor displays status and network messages in the message area at the bottom of the screen.

Diagnostic messages appear during the self-test routines that occur immediately after you turn the monitor on.

Alarm and most status and network messages appear alternately until the condition has been resolved. Diagnostic messages and some status and network messages appear only once.

Whenever possible, Dräger recommends that you check the equipment and the accessories carefully before monitoring your patient to eliminate faulty conditions. Careful patient preparation will also eliminate most common error conditions.

STOP   **WARNING: Do not operate the monitor if you detect any equipment malfunction. In this case, take the unit out of operation and call your Biomed or DrägerService.**

Heart Rate (HR), Arrhythmia (ARR) and ST Segment Analysis (ST)

Displayed Message	Possible Cause	Suggested Action
Message: Arrhythmia Relearning *Parameter value: LRN*	The monitor is learning the patient's normal QRS complex to use as reference.	• Wait until the message disappears from the screen.
Message: Asystole *Parameter value: ASY*	No QRS detection for the last 4 seconds. Heart rate is below 15 beats/ minute.	• Observe the patient and treat if clinically indicated. • Select a lead with at least an amplitude of 0.5 mV. • Select another lead to meet the above criterion. • Reposition or change the electrodes if the amplitude is still low. • Use good skin preparation.
*Message: RL Lead Off *** *HR parameter value: <value>* *ST<lead1>/ST<lead2>* *parameter value: <blank>* *Message: V Lead Off *** *Message: V+ Lead Off* *Message: RA Lead Off* *Message: LL Lead Off* *Message: LA Lead Off* *Message: ECG Leads Off* *HR parameter value: **** *ST<lead1>/ST<lead2>* *parameter value: <blank>*	The monitor has detected a lead-off condition for the currently processed lead. The cause could be one of the following: Unplugged cable Broken cable Loose lead wire Faulty lead wire Dried out gel on the electrode Wrong cable type selection. The MULTIMED/ NEOMED pod may be defective.	• Check the patient cable and lead wires carefully. • Check the MULTIMED/ NEOMED pod. Replace pod if defective. • Replace any cable or lead wire that is suspect. • Reapply gel on the electrode or change the electrode (if disposable). • Select another ECG lead for processing if the electrode or lead cannot be replaced.
* For all the electrode disconnected messages (V, V+ RA, LL, LA, RL) the parameter box will show *** if this is the lead currently being monitored. If another valid lead is being monitored (i.e. ECG 1&2) then the parameter value for HR, ST<lead1> and ST<lead2> will be <value>		
Message: ARR Cannot Learn Lead <lead> *Parameter value: <value>*	Lead not connected.	• Check lead connections

Heart Rate (HR), Arrhythmia (ARR) and ST Segment Analysis (ST)

Message: ECG Artifact *HR parameter value: **** *ST<lead1>/ST<lead2>* *parameter value: <blank>*	Patient's movement. Shivering, tremors. Excessive signal noise. Bad contact of electrodes. Interference from auxiliary equipment.	• Calm the patient. • Check the electrodes. • Apply the electrodes carefully. • Secure the electrodes. • Observe good skin preparation techniques. • Isolate the patient from auxiliary equipment, if possible. • If the artifact message is frequent, contact your Biomed to check the setting of the notch 50/60 Hz filter.
Message: HR Too High *Parameter value: +++*	The patient's heart rate falls outside the upper range (300 beats per minute).	• Observe the patient carefully. • Apply treatment if clinically indicated.
Message: HR>UL *<value>* *Message: HR <LL* *<value>* *Parameter value: <value>*	The patient's heart rate falls outside the current upper or lower alarm limits. The current alarm limits are inappropriate for this patient	• Observe the patient carefully. • Apply treatment if clinically indicated. • Change the alarm limits as described in the "HR Alarms" section.
Message: MultiMed Disconnected *PVC parameter value: <blank>* *HR parameter value: **** *ST<lead1>/ST<lead2>* *parameter value: <blank>*	The MULTIMED/NEOMED pod is disconnected from the monitor.	• Verify the pod connections.
Message: Pacer Detection Off	Pacer detection is not selected.	• If you are monitoring a paced patient, select the pacer detection function.

Heart Rate (HR), Arrhythmia (ARR) and ST Segment Analysis (ST)

Message: V Fib *Parameter value: VF*	Detection of a ventricular fibrillation. The ventricular rhythm is chaotic.	• Observe the patient and treat if clinically indicated. • View each lead on the monitor and check the amplitude. To detect the QRS, the amplitude should be at least 0.5 mV on the mV scale. • Reposition or change the electrodes if the amplitude is still low. • Use good skin preparation.
Message: V Tach *Parameter value: VT*	*n* or more consecutive PVCs have been detected with a beat-to-beat rate greater than or equal to the VT rate set in the Alarm Tables. (*n* = VT count parameter)	• Observe the patient and treat if clinically indicated.
Message: Bradycardia *Parameter value: BRDY*	8 or more consecutive QRS complexes have been detected with a beat-to-beat rate less than 80% of the patient's normal rate.	• Observe the patient and treat if clinically indicated.
Message: RUN *Parameter value: RUN*	3 to N-1* consecutive PVCs with a beat-to-beat rate >= the VT rate	• Observe the patient and treat if clinically indicated.
Message: AIVR *Parameter value: AIVR*	3 or more PVCs with a rate < the VT rate	• Observe the patient and treat if clinically indicated.
Message: SVT *Parameter value: SVT*	N* or more consecutive normal beats with a beat-to-beat rate >= the SVT rate	• Observe the patient and treat if clinically indicated.
Message: CPT *Parameter value: CPT*	A sequence of beats with the pattern: normal, PVC, PVC, normal	• Observe the patient and treat if clinically indicated.
Message: BGM *Parameter value: BGM*	A sequence of beats with the pattern: normal, PVC, normal, PVC, normal	• Observe the patient and treat if clinically indicated.

Heart Rate (HR), Arrhythmia (ARR) and ST Segment Analysis (ST)

Message: TACH *Parameter value: TACH*	N* or more consecutive normal beats with a beat-to-beat rate >= the TACH rate	• Observe the patient and treat if clinically indicated.
Message: PAUS *Parameter value: PAUS*	A sequence of two normal beats with an N-N* interval > the Pause rate times the average N-N interval (±100ms)	• Observe the patient and treat if clinically indicated.
Message: ST <lead> Off *ST<lead1> and* *ST<lead2> parameter* *value: ****	The monitor has detected a lead-off condition for the currently processed lead. The cause could be one of the following: Unplugged cable Broken cable Loose lead wire Faulty lead wire Dried out gel on the electrode Wrong cable type selection. The MULTIMED/ NEOMED pod may be defective.	• Check the patient cable and lead wires carefully. • Check the MULTIMED pod. Replace pod if defective. • Replace any cable or lead wire that is suspect. • Reapply gel on the electrode or change the electrode (if disposable). • Select another ECG lead for processing if the electrode or lead cannot be replaced.
Message: Cannot Analyze *ST<lead1> and* *ST<lead2> parameter* *value: <blanK>*	ST cannot analyze with a paced beat	• ST segment analysis cannot be performed on pacemaker patients
Message: ST Too High *ST<lead1> and* *ST<lead2> parameter* *value: +++* *Message: ST Too Low* *ST<lead1> and* *ST<lead2> parameter* *value: ---*	The detected ST value is outside the measurement range.	• Check the patient and apply treatment if necessary. • Check the electrode placement and change their position if necessary.

Heart Rate (HR), Arrhythmia (ARR) and ST Segment Analysis (ST)

Message: ST > UL *ST<lead1> and ST<lead2> parameter value: <value>* *Message: ST < LL* *ST<lead1> and ST<lead2> parameter value: <value>*	The ST rate falls outside the current upper or lower alarm limits. The current alarm limits are inappropriate for this patient.	• Observe the patient carefully. • Apply treatment if clinically indicated. • Change the alarm limits as described in the "Cardiac Monitoring" chapter.
Message: ST Lead <1> and/or ST Lead <2> Invalid *ST<lead1> and/or ST<lead2> parameter value: <blank>*	Invalid ST<lead-name>. ST<lead1> or ST<lead2> connection restored from a fault. Excessive signal noise. Bad contact of electrodes. Interference from auxiliary equipment.	• Select correct ST lead(s). • Verify ST lead(s) connection.

Respiration

Displayed Message	Possible Cause	Suggested Action
Message: Apnea *Parameter value: Apn*	The monitor is detecting an apnea event that exceeds the apnea time set in the menu. Incorrect placement of the electrodes. Improper threshold. Missed shallow breaths.	• Check the patient. Treat the patient, if clinically indicated. • If the absence of impedance changes is due to the placement of the electrodes, reposition them until the message clears. • If apnea is due to an improper threshold, set the threshold until the message clears. • If breaths are missing, use the manual respiration mode to ensure the detection of shallow breaths.
Message: MultiMed Disconnected *Parameter value: ****	The MULTIMED/ NEOMED pod is disconnected from the monitor.	• Verify the pod connections.
Message: Coincidence *Parameter value: <value>* (Neonatal mode only)	The impedance changes due to cardiac activity are being counted as breaths.	• Check the patient. • Check the electrode placement.
Message: Rsp Fault *Parameter value: ****	Technical problem.	• Turn the monitor off, then on. • If the problem persists, take the unit out of operation and call DrägerService.
Message: Rsp High Impedance *Parameter value: ****	Impedance out-of-range. Broken cables. Dried out gel on the electrodes. Poor skin preparation.	• Check the cables for damage. • Check the electrodes. • Move the electrodes, if necessary.
Message: Rsp Testing *Parameter value:<blank>*	Self-tests in progress. No displayed value.	• Wait until the end of the self-tests.

Respiration (continued)

Message: Rsp > <UL value> *Message: Rsp < <LL value>* *Parameter value: <value>*	The respiration rate falls outside the current upper or lower alarm limits. The current alarm limits are inappropriate for this patient.	• Observe the patient carefully. • Apply treatment if clinically indicated. • Change the alarm limits as described in the "Respiration Alarms" section.
Message: Rsp Artifact *Parameter value: ****	High frequency artifact in the signal. Large baseline shifts. Patient movement. TENS interference. IV infusion pump interference.	• Check the electrodes and reposition them. • Find the source of interference and remove it. • Replace the electrodes if necessary. • Change the cable or lead wires.
Message: Rsp Lead Off *Parameter value: ****	The cause could be one of the following: Unplugged cable. Broken cable. Loose lead wire. Faulty lead wire. Dried out gel on electrodes. The MULTIMED/NEOMED pod may be defective.	• Check patient cable and lead wires carefully. • Replace any cable or lead wire that is suspect. • Reapply gel or change the electrode. • Check the MULTIMED/NEOMED pod and replace, if necessary.
Message: Rsp Learning *Parameter value: LRN*	The monitor is learning the patient's normal respiration pattern to establish detection threshold.	• Wait for the respiration rate to appear on the display.
Message: Rsp Too High *Parameter value: +++*	The respiration rate is higher than 155 breaths per minute. The monitor may be counting artifacts. Interference due to auxiliary equipment.	• Check the patient and apply treatment if necessary. • Check the electrode placement and change their position if necessary. • Move the electrodes away from the source of interference.

Respiration (continued)

| Message: Use ECG II for Rsp
Parameter value: *** | An ECG lead other than lead II is displayed while 3 ECG lead cable is selected. | • Select Lead II to ensure accurate respiration monitoring. |

End Tidal CO$_2$ (etCO$_2$), Inspired CO$_2$ (iCO$_2$), and RRc

Displayed Message	Possible Cause	Suggested Action
Message: etCO$_2$ Sensor Unplugged Parameter value: ***	Capnostat sensor is unplugged.	• Disconnect the etCO$_2$ sensor, then reconnect it. If the message persists, try a new sensor.
Message: etCO$_2$ Unplugged Parameter value: ***	etCO$_2$ pod is unplugged.	• Check etCO$_2$ pod connection. • Disconnect the etCO$_2$ pod, then reconnect it. If the message persists, contact your Biomed.
Message: etCO$_2$ > UL Message: etCO$_2$ < LL Parameter value: <value>	etCO$_2$ is outside alarm limits because of: • A physiological condition. • Inappropriate alarm limits. • A defective sensor or etCO$_2$ pod.	• Check the patient and treat if necessary. • Change the alarm limits • Check equipment and replace if necessary.
Message: iCO$_2$ > UL Parameter value: <value>	iCO$_2$ is above alarm limits because of: • A physiological condition. • Rebreathing. • Inappropriate alarm limits. • A defective sensor or etCO$_2$ pod	• Check the patient. • Check ventilator for: • --inspiratory flow --expiratory time --faulty expiratory valve • Change the alarm limits • Check equipment and replace if necessary.

End Tidal CO$_2$ (etCO$_2$), Inspired CO$_2$ (iCO$_2$), and RRc (continued)

Message: RRc > UL *Message: RRc < LL* *Parameter value: <value>*	RRc is outside alarm limits because of: • A physiological condition. • Inappropriate alarm limits. • A defective sensor or etCO$_2$ pod.	• Check the patient and treat if necessary. • Change the alarm limits • Check equipment and replace if necessary.
Message: etCO$_2$ Too High *Parameter value: ****	CO$_2$ value is out of range (high).	• Check the patient and treat if necessary. • Recalibrate the sensor.
Message: RRc Too High *Parameter value: ****	RRc value exceeds the upper range.	• Check the patient and treat if necessary. • Recalibrate the sensor.
Message: etCO$_2$ Atm. Press. Sensor Failure *Parameter value: ****	*etCO$_2$ pod barometric pressure sensor failure*	• Try the sensor again. If the message persists, try a new sensor.
Message: etCO$_2$ Calibrate Atm. Press. *Parameter value: ****	*etCO$_2$ pod barometric pressure sensor calibration needed*	• Shift to Manual mode and dial in pressure. • If automatic pressure required, return to Biomed.
Message: etCO$_2$ Sensor Warming Up *Parameter value: <value>*	CAPNOSTAT has not yet reached a stable temperature.	• Wait for the sensor to warm up (up to three minutes at room temperature). If the message fails to clear, call Biomed.
Message: etCO$_2$ Sensor Failure *Parameter value: ****	CAPNOSTAT source current is out of range or sensor did not warm up within 3 minutes.	• Try the sensor again. If the message persists, try a new sensor.
Message: etCO$_2$ Sensor too warm *Parameter value: ****	External heat source is warming the sensor.	• Remove heat source. • If the problem persists, disconnect and reconnect the sensor. • Replace the sensor.
Message: etCO$_2$ Place Sensor on Zero Cell *Parameter value: ****	Last sensor calibration failed or is not the last sensor calibrated on this pod.	• Place the sensor on the zero cell and wait for zeroing to complete.

End Tidal CO$_2$ (etCO$_2$), Inspired CO$_2$ (iCO$_2$), and RRc (continued)

Message: etCO$_2$ Sensor Temp Not Stable *Parameter value:* ***	The sensor temperature is unstable following warm-up.	• Wait at least three minutes for the message to disappear. If the message persists, replace the reusable sensor.
Message: Check etCO2 Check Airway Adapter/ Cal. *Parameter value:* ***	Airway adapter is dirty, not fully seated, or out or calibration.	• Make sure the adapter is properly seated. • Clean and calibrate the airway adapter.
Message: etCO$_2$ Calibrating Sensor *Parameter value: <blank>*	Calibrating on zero cell.	• Informational message; no action required.
Message: etCO$_2$ Cannot Cal. Sensor *Parameter value:* ***	Calibration on zero cell could not be completed because of CAPNOSTAT temperature instability.	• Check for any heat sources warming the sensor and remove them. • Wait at least three minutes for the temperature to stabilize.
Message: etCO$_2$ Adapter Failure *Parameter value:* ***	Airway adapter is dirty, not fully seated, or out of calibration.	• Make sure the adapter is properly seated. • Clean and calibrate the reusable airway adapter.
Message: etCO$_2$ Place Sensor On Ref Cell *Parameter value: <value>*	Calibration on zero cell completed successfully.	• Place sensor on the reference cell and wait for calibration to complete.
Message: etCO$_2$ Sensor Cal. Failed *Parameter value:* ***	Calibration on zero cell failed.	• Recalibrate. If the message persists, try a new sensor.
Message: etCO$_2$ Verifying Sensor Cal *Parameter value:* ***	Calibrating on reference cell.	• Informational message; no action required.
Message: etCO$_2$ Sensor Cal. Verified *Parameter value: <value>*	Verification completed successfully.	• Informational message; no action required.

End Tidal CO$_2$ (etCO$_2$), Inspired CO$_2$ (iCO$_2$), and RRc (continued)

Message: etCO$_2$ Calibrating Adapter *Parameter value: <blank>*	Airway adapter calibration (zeroing in room air) in progress.	• Informational message; no action required.
Message: etCO$_2$ Cal. Failed, Breaths? *Parameter value: <value>*	Breaths detected during the 20 second period following activation of the Adapter Cal. key.	• Make sure that the sensor is not connected to the patient's ventilator breathing circuit and is not close to a CO$_2$ source. Recalibrate.
Message: etCO$_2$ Cannot Cal. Adapter *Parameter value: <value>*	Airway adapter cal. (zeroing in room air) could not be completed because of CAPNOSTAT temperature instability, or because the CAPNOSTAT was on the zero cell.	• Recalibrate holding sensor in room air (not on zero cell). • Wait at least three minutes for temperature to stabilize and recalibrate. • Remove any heat source warming the sensor and recalibrate. • Remove sensor from Zero cell, place on the adapter, and recalibrate.
Message: etCO$_2$ Adapter Cal. Accepted *Parameter value: <value>*	Airway adapter calibration (zeroing in room air) completed successfully.	• Informational message.
Message: etCO$_2$ Adapter Cal. Failed *Parameter value: <value>*	Airway adapter calibration (zeroing in room air) failed.	• Make sure the adapter is properly attached to the sensor and that its windows are clean. • If the problem persists, try another adapter.
Message: etCO$_2$ Incompatible Pod *Parameter value: ****	Corrupt software. Wrong version of software or hardware.	• Try a new pod. • Consult your hospital's Biomed.
Message: etCO$_2$ Adapter Cal. Required *Parameter value: ****	Sidestream measurement mode was initiated, requiring airway adapter cal. (zeroing in room air) to calibrate pump/flow.	• Calibrate the new adapter.

End Tidal CO$_2$ (etCO$_2$), Inspired CO$_2$ (iCO$_2$), and RRc (continued)

Message: etCO$_2$ Tubing Blocked *Parameter value: ****	Sidestream tubing obstructed, or filter is clogged.	• Clear the blockage in the tubing. • Replace the pod.
Message: etCO$_2$ Tubing Leak *Parameter value: ****	Sidestream tubing has a leak.	• Change the tubing.
Message: etCO$_2$ Hardware Failure *Parameter value: ****	etCO$_2$ communication or hardware failure.	• Check etCO$_2$ pod connection. • Check all tubing • Disconnect the etCO$_2$ pod, then reconnect it. If the message persists, contact your Biomed.

Multigas

Displayed Message	Possible Cause	Suggested Action
Message: iCO$_2$/etCO$_2$ Out of Range *Parameter value: +++*	The inspired/expired concentrations fall outside the monitor's display range.	• Observe the patient; treat, if necessary. • Check connections. • Disconnect and reconnect the Scio module. • Power-cycle the monitor or undock/redock the monitor from the Docking Station. • Contact DrägerService.
Message: iO$_2$/etO$_2$ Out of Range *Parameter value: +++*		
Message: i/et \<agent\> Out of Range *Parameter value: +++*		

Multigas (continued)

Message: iO$_2$ > UL *Message: iO$_2$ < LL* *Parameter value: <value>*	The inspired/expired concentrations fall outside the current upper or lower alarm limits.	• Observe the patient; treat, if necessary. • Adjust alarm limits.
Message: etO$_2$ > UL *Message: etO$_2$ < LL* *Parameter value: <value>*		
Message: i <agent> > UL *Message: i <agent> < LL* *Parameter Value: <value>*		
Message: et <agent> > UL *Message: et <agent> < LL* *Parameter value: <value>*		
Message: <agent> detected *Parameter value: <blank>*	The user has specified an agent (Agent Override), but Scio is detecting a different agent.	• Turn Agent Override off.
Message: Mixed Agents *Parameter value: ****	Scio is sensing more than one agent in the breathing circuit.	• After a change of agent, wait until all traces of the first agent have been cleared out of the breathing circuit.
Message: <parameter> reduced accuracy *Parameter value: <value>*	Scio reports reduced or unknown accuracy even after completion of warm-up period.	• Observe the patient; treat, if necessary. • Check connections. • Disconnect and reconnect the Scio module. • Power-cycle the monitor or undock/redock the monitor from the Docking Station. • Contact DrägerService.
Message: Multigas Unplugged *Parameter value: ****	No connection or faulty connection between monitor and Scio module.	• Check connections and cables. • If message persists, contact DrägerService.

Multigas (continued)

Message: Multigas H/W failure *Parameter value: ****	Loss of communication or hardware problem detected.	• Check connections. • Disconnect and reconnect the Scio module. • Power-cycle the monitor or undock/redock the monitor from the Docking Station. • Contact DrägerService.
Message: Multigas initialization *Parameter value: <blank>*	Scio start-up mode.	• Informational message.
Message: Multigas warming up *Parameter value: <values>*	Scio warm-up period: Reduced accuracy.	• Displayed values might not be accurate. Scio reaches full accuracy after a warm-up period of about 5 minutes.
Message: Multigas zero in 1 minute *Parameter value: <values>*	Scio will start the automatic zeroing process in one minute.	• To delay zeroing for 5 minutes, click on Autozero Delay in the Multigas Setup menu (see the chapter *Multigas*).
Message: Multigas zero in progress *Parameter value: <values>*	Scio is undergoing automatic zeroing process. During zeroing (< 25s), the monitor does not update the displayed gas values.	• Wait until zeroing is completed. During zeroing, displayed gas values might not be accurate.
Message: Multigas zero OK *Parameter value: <values>*	Scio zeroing was successful.	• Informational message.
Message: Multigas zero failed *Parameter value: ****	Scio zeroing was not successful.	• Verify that the environment does not contain contaminants. • Check for leaks or occlusions. • Contact DrägerService.
Message: Multigas Tubing Blocked *Parameter value: ****	Scio reports an occlusion or pneumatic problem.	• Check all catheters for occlusion. • If necessary, replace catheters.

Multigas (continued)

Message: Multigas Check Watertrap *Parameter value: <values>*	Scio reports a full watertrap.	• Empty/replace water-trap (see the chapter *Multigas*).
Message: Multigas Fan Failure *Parameter value: ****	Fan port blocked. Hardware problem.	• Check fan port and remove blockage. • Contact DrägerService.

Pulse Oximetry (SpO$_2$)

Displayed Message	Possible Cause	Suggested Action
Message: PLS Too High *Parameter value: +++*	Motion artifact.	• Calm the patient.
Message: SpO$_2$ Fault - Power Cycle Monitor *Parameter value: **** *Message: PLS Fault* *Parameter value: ****	The monitor has detected a hardware failure.	• Turn the monitor off, then on. • If the message does not clear, take the unit out of operation and call your Biomed.
Message: MultiMed Disconnected *SpO2 and PLS parameter value: <blank>*	The MULTIMED/NEOMED pod is disconnected from the monitor.	• Verify the pod connections.
Message: SpO$_2$ Light blocked *Message: PLS Light blocked* *Parameter value: ****	The sensor does not detect the light. The sensor cannot detect a signal that can be measured.	• Check the sensor. • Make sure the light indicator is not blocked. • Remove any trace of nail polish. • Move sensor location. • Use different sensor.
Message: SpO$_2$ Weak Signal *Message: PLS Weak Signal* *Parameter value: ****	The sensor may be faulty. The sensor cannot detect a signal that can be measured.	• Remove bandages or rings that may obstruct the signal. • Reapply the sensor. • Observe the waveform on the screen. If you suspect a faulty sensor, replace it.

Pulse Oximetry (SpO$_2$)   (continued)

Message: SpO$_2$ Motion *Parameter value: **** *Message: PLS Motion* *Parameter value: ****	The monitor has detected motion artifacts in the signal. The cause can be one of the following: The patient is moving The patient is coughing Hemodynamic interference Hypothermia Vascular compromises to the extremity	• Move sensor to another location. • Observe the resulting waveform on the screen.
Message: SpO$_2$ No measurement *Message: PLS No measurement* *Parameter value: ****	The monitor has been unable to measure the parameter for the last 30 seconds.	• Calm the patient. • Check the sensor placement. • Move the sensor to a location with less movement. • If message persists, call DrägerService.
Message: SpO$_2$ Regulate Error *Message: PLS Regulate Error* *Parameter value: ****	The monitor detects an excessive amount of ambient light giving low amplitude and inaccurate readings as a result. The possible sources of excessive light are: Surgical or bilirubin lamp Fluorescent lights Infrared heating lamps Sunlight	• Cover the sensor with an opaque material such as a towel.
Message: SpO$_2$ Searching Parameter value: <blank>	The monitor is analyzing the signal. This occurs during the first 5 to 10 s of operation or as a result of motion artifact.	• Wait until the message disappears from the screen.
Message: SpO$_2$ Transparent *Message: PLS Transparent* *Parameter value: ****	The sensor may be disconnected from the patient. Sensor may be defective.	• Check sensor and connections. • If problem persists, change sensor.

Pulse Oximetry (SpO$_2$)   (continued)

Message	Cause	Action
Message: SpO$_2$ Unplugged *Message: PLS Unplugged* *Parameter value: ****	The sensor's extension cable disconnected from the pod. The sensor is disconnected from the extension cable. The MULTIMED/NEOMED cable is defective. The sensor is defective. The sensor is not recommended for use with your monitor.	• Verify sensor to extension cable connection. • Verify extension cable to pod connection. • Verify pod connection to monitor. • Verify correct sensor.
Message: Replace SpO$_2$ Sensor	The SpO$_2$ sensor is not functioning properly.	• Replace the sensor.
Message: SpO$_2$ <LL <value> *Message: SpO$_2$ >UL <value>* *Parameter value: <value>* *Message: PLS<LL <value>* *Message: PLS>UL <value>* *Parameter value: <value>*	The patient's oximetry level or pulse rate falls outside the current alarm limits. The alarm limits are inappropriate for this patient. The SpO$_2$ level has changed since you last selected the alarm limits. Elevated carboxyhemoglobin or methemoglobin levels. Significant levels of intravascular dyes. Placement of sensor on an extremity that has a blood pressure cuff, arterial catheter or intravascular line. Faulty equipment.	• Observe the patient. • Apply treatment if clinically indicated. • Change the alarm limits. • If you suspect a sensor failure, check and replace the sensor, if necessary.
Message: *SpO2: non-Masimo sensor* *SpO2: non-Nellcor sensor* *Parameter Value: ****	Sensor not compatible with monitor configuration.	• Use compatible sensor (Masimo/Nellcor). • Contact your hospital's Biomedical department to change the monitor configuration.

Temperature (T)

Displayed Message	Possible Cause	Suggested Action
Message: T >UL <value> *Message: T <LL <value>*	The patient's temperature falls outside the current temperature alarm limits.	• Observe the patient. • Change the alarm limits for this patient. • If you suspect a temperature probe failure, check and replace it.
Message: MultiMed Disconnected *Parameter value: <blank>*	The MULTIMED/NEOMED pod is disconnected from the monitor.	• Verify the pod connections.
Message: T Fault *Parameter value: ****	The monitor has detected a hardware failure.	• Turn the monitor off, then on. • If the message does not clear, take the unit out of operation and call your Biomed.
Message: T Unplugged *Parameter value: ****	The temperature probe is disconnected from the MULTIMED/NEOMED pod. The MULTIMED/NEOMED cable is defective. The probe is defective. The probe is not recommended for use with your monitor.	• Verify the probe connection to the pod. • Verify the probe. If defective, change the probe.
Message: T Test Fail	The monitor has detected a problem in the temperature sensor during startup.	• If the test fails, turn the monitor off, then on. • If the message does not clear, take the unit out of operation and call your Biomed.
Message: T Too Low *Message: T Too High* *Parameter value: <blank>*	The detected temperature is outside the measurement range.	• Check your patient. • Check the probe for defects. • Check the patient cable connections. • Change the probe, if necessary.

Invasive Blood Pressure (IBP1, IBP2)

Displayed Message	Possible Cause	Suggested Action
IBP Low Pulse	Systolic and diastolic values are less than 60% of the baseline. Elevated heart rate. Hemodynamic interference (e.g., decreased stroke volume). Clot has formed on the catheter tip. Catheter is lodged against the vessel wall. Transducer is not properly aligned to the patient's heart level. Air in tubing. Kinked tubing.	• Check the patient. • Zero and check the transducer calibration factor. • Remove the clot by opening the stopcock to the patient and drawing back with a sterile syringe. • If you cannot draw back, follow your hospital procedure for removing clots. • Straighten all tubing. If air is present in the tubing, follow your hospital procedures for removing, flushing and repositioning the catheter.
Message: IBP Static Parameter value: *<value>*	This message appears when the invasive pressure alarms are on while zeroing. No pulse.	• Turn combined systolic and diastolic alarm off. • Check the patient. • Repeat zeroing.
Message: IBP Sys <LL <value> Message: IBP Sys >UL <value> Message: IBP Mean <LL <value> Message: IBP Mean >UL <value> Message: IBP Dia <LL <value> Message: IBP Dia >UL <value> Parameter value: <value>	The patient's invasive pressure falls outside the current alarm limits. The current alarm limits are inappropriate for this patient.	• Observe the patient. • Change the current alarm limits.
Message: IBP Too High Parameter value: +++ Message: IBP Too Low Parameter value: - - -	The value is outside the measurement range. The transducer may be picking up pressure from the IV infusion system.	• Check the connections and cables. • Zero and calibrate the transducer, if necessary.
Note that the label "IBP" is replaced on screen with the user-defined label (e.g., "*ART Too Low*").		

Non-Invasive Blood Pressure (NBP)

Displayed Message	Possible Cause	• Suggested Action
Message: NBP Cannot Measure *Parameter value:* ***	Faulty equipment. Improper cuff placement. Patient's pulse too low. Excessive patient movement.	• Check the patient. • Check the hose and cuff. • Move the cuff to a limb with less movement. • Check proper placement of the cuff. • Restart measurement.
Message: NBP Artifact *Parameter value:* ***	The patient is moving or shivering.	• Check the patient. • Move the cuff to a different limb with less movement.
Message: NBP No Pulsation *Parameter value:* ***	Weak signal. Monitor is unable to detect a sufficient number of pulsations of adequate amplitude within two minutes.	• Check the patient and treat if necessary. • Check the hose and cuff. • Check for proper size, placement of cuff.
Message: NBP Cuff Leak *Parameter value:* ***	The monitor has detected a significant drop in the cuff pressure during inflation.	• Check for leaks in the cuff or hose. • Change the cuff and hose, if necessary.
Message: NBP Fault - Power Cycle Monitor *Parameter value:* ***	Faulty equipment. Improper cuff placement. Transducer needs calibration. NBP hardware needs repair or calibration. Hardware safety timer has expired.	• Check the hose and cuff. • Check proper placement of cuff. • Turn the monitor off, then on if you detect a hardware failure. • If the message does not clear, take the unit out of operation and call your Biomed or DrägerService.

Non-Invasive Blood Pressure (NBP) (continued)

Message: NBP Mean Only *Parameter Value:* *NBP M <value>* *NBP S <***>* *NBP D <***>*	The patient's pulse is too low for the monitor to derive the systolic and diastolic pressure values but large enough to report the mean pressure value. Improper cuff placement	• Check the patient. • Check proper placement of the cuff.
Message: NBP Meas. Time-out *Parameter value: ****	Measurement time has exceeded 2 minutes.	• Repeat the measurement.
Message: NBP Open Line *Parameter value: ****	There is no significant increase in cuff pressure during the inflation cycle.	• Verify the cuff connection.
Message: NBP blocked Line *Parameter value: ****	There is a significant increase in cuff pressure during the inflation cycle. Blocked output condition detected. Cuff or tubing may be obstructed.	• Substitute cuff or tubing if necessary.
Message: NBP Overpressure *Parameter value: ****	The cuff pressure exceeds the overpressure threshold.	• Call your Biomed.
Message: NBP Sys <LL <value> *Message: NBP Sys >UL <value>* *Message: NBP Dia <LL <value>* *Message: NBP Dia >UL <value>* *Message: NBP Mean >UL <value>* *Message: NBP Mean <LL <value>* *Parameter value: <value>*	The patient's pressure falls outside the current alarm limits or these limits are inappropriate for this patient.	• Observe the patient. • Change the current alarm limits for this patient.

Non-Invasive Blood Pressure (NBP) (continued)

Message: NBP Out of Range *Parameter value:* ***	NBP values are above/below the NBP measuring range.	• Check patient and treat, if necessary. • Verify that the inflation mode is appropriate for the patient. Change if necessary.
Message: NBP Low Inflation Limit *Parameter value:* ***	The patient's systolic pressure is above the current inflation limit.	• Change to a higher inflation limit.
Message: NBP Check Cuff Size *Parameter value:* ***	The wrong size NBP cuff is being used on the patient.	• Verify the cuff size and placement are proper for the patient. • Verify all connections. • Change the cuff if necessary.
Message: NBP Check Hose Connection *Parameter value:* ***	There is no significant increase in cuff pressure during the inflation cycle.	• Verify all connections. • Change the hose if necessary.

6 Trends

Overview

The monitor can store the last 24 hours of trended data. If there is no alarm, the monitor averages the monitored vital signs every minute and stores the results in its trend memory.

You can view the trends in the following formats:

- As a graph (graphical trends).
- As a table (tabular trends).

Graphical and tabular trended values are displayed from left to right in increasing time. If you discharge or admit a patient, the monitor erases trend data, patient data, and stored recordings/ events. Network time changes are reflected in both the graphical and tabular trends.

By default, HR, SpO2 and NBP are the first three parameters displayed on the graphical and tabular trend screens. However, you can select any three parameters for the top positions on these screens (see below). The order of these parameters is saved as part of the setup, when you save the current monitoring configuration (see the chapter *Monitor Setup*).

For non-invasive blood pressure, the monitor stores a trend value at the end of a successful measurement, or an error code at the end of an unsuccessful measurement, but never more frequently than once every sixty seconds (i.e., if you take two NBP measurements within one minute, the monitor stores only the last measurement as a trend value).

Trend Setup

Select trend parameters for the three top positions on the trend display as follows:

STEPS: Selecting Parameters for Trend Channel Display

1. Press the **Menu** fixed key.
2. Click on **Monitor Setup**.
3. Click on **Trend Setup**.
4. Click on the desired trend display **Channel**.
5. Select the desired parameter and click the knob.

Trend Graphs

Trend Graphs display up to 12 hours of trended data at a time, sampled and updated every minute. When you first access the graphical trend screen, the monitor shows the most recent trend values plotted against a time grid along the horizontal axis of the graph.
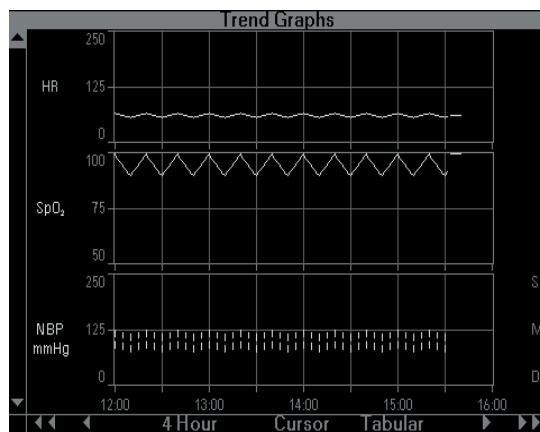
The monitor identifies parameters by their color on the graph (labels and waveforms). When you click on the trend cursor (see below) trend values appear to the right of the graph in white or in the color of the alarm grade, if the parameter was in alarm during the one-minute trend sampling interval.

Each trended parameter has a scaled vertical axis to the left of the trend display channel. Values that fall outside the trend scale are plotted at the maximum or minimum of that scale. To see these values, move the cursor to the plotted line and read the values on the graph.

Pressure trend graphs (NBP, GP1, GP2) show small vertical segments: a top segment for the systolic pressure, a bottom segment for the diastolic pressure, and a blank segment in between, representing the mean pressure. Mean only values are plotted as single curves.

STEPS: Calling up Trend Graphs

1. Press the **Menu** fixed key.

2. Click on **Review**.

3. Click on **Trend Graphs**.

> **NOTE:** You can also call up the Trend Graphs by pressing the Fast Access fixed key.

STEPS: Navigating the Trend Graphs Screen

- **Up and down arrows** — scroll through the available parameters one page at a time.

- **Left and right single arrows** — scroll through older or more recent trend data.

- **Left and right double arrows** — view the oldest or the most recent trend data.

- **Hour button** — select a trend window of 1, 2, 4, 8 or 12 hours. A smaller time scale (i.e. 1 hour) displays more detail than a larger time scale (i.e. 12 hours). The time-stamps on the horizontal time axis reflect the scale selected.

- **Cursor** — display or hide a vertical cursor. Turn the rotary knob to move the cursor to a specific location (time) on the trend graphs screen. The stored trend values corresponding to that location appear to the right of the trend display channels.

- **Tabular** — call up the Trend Table.

> **NOTE:** If you try to scroll past the end of the trend graphs screen, the monitor emits an error tone.

Trend Table

The trend table shows up to 1 hour of trended data at a time.
When you first access the trend table, the monitor shows the most
recent trend values in the right column for the parameters being
monitored.

Trend Table		15:15	15:20	15:25	15:30	15:33	15:38
HR		60	65	60	55	60	55
SpO$_2$		95	100	95	90	95	90
NBP S	mmHg	120	125	120	115	120	115
NBP M	mmHg	100	105	100	95	100	95
NBP D	mmHg	80	85	80	75	80	75
PLS		60	65	60	55	60	55
etCO$_2$	mmHg	20	25	20	15	20	15
iCO$_2$	mmHg	5	10	5	0	5	0
RRc		20	25	20	15	20	15
STII	mm	0.1	0.6	0.1	-0.4	0.1	-0.4
STV	mm	-0.1	0.4	-0.1	-0.6	-0.1	-0.6
GP1 S	mmHg	120	115	120	115	120	115
GP1 M	mmHg	100	95	100	95	100	95
GP1 D	mmHg	80	75	80	75	80	75

15 Min — Graphical

The monitor identifies parameter labels by their color. Trend val-
ues appear in white or in the color of the alarm grade, if the
parameter was in alarm during the one-minute trend sampling
interval.

STEPS: Calling up the Trend Table

1. Press the **Menu** fixed key.

2. Click on **Review**.

3. Click on **Trend Tables**.

➤ **NOTE:** You can also call up the Trend Table by pressing the Fast
Access fixed key.

STEPS: Navigating the Trend Table

- **Up and down arrows** — scroll through the available parameters one page at a time.

- **Left and right single arrows** — scroll through older or more recent trend data.

- **Left and right double arrows** — view the oldest or the most recent trend data.

- **Minutes (Min)** — select a trend window of 1, 5, 15, 30 or 60 minutes. Data columns are spaced according to the selected window.

➤ **NOTE:** Completed NBP measurement add an extra column to the table.

- **Graphical** — call up the Trend Graphs screen.

➤ **NOTE:** If you try to scroll past the end of the trend graphs screen, the monitor emits an error tone.

Special Conditions and Codes

When a parameter is not monitored during a trend sampling interval, the value is blank on the trend display.

When alarms are enabled, the monitor stores and displays the first occurrence of the alarm with the highest priority detected during the one-minute trend sampling interval. Trend storage and display priorities are as follows:

1. Power-up, testing, and standby.

2. Life-threatening alarms (i.e. ASY, VT, VF).

3.   Out-of-range conditions (+++ or ---).

4. Serious alarms: Alarm limit violations and apnea.

5. Advisory alarms: Artifact and lead-off conditions.

For conditions that fall under the same priority, the monitor stores and displays the first condition detected during the trend sampling interval.

Life-threatening alarms are marked by a small dot on the bottom of the HR trend channel on the Trend Graphs screen.

Technical conditions show a gap on the trend displays and the trend value is replaced by one of the technical codes listed below.

Technical Code	Condition
– – –	Lower measuring range exceeded (IBP, ST)
+++	Upper measuring range exceeded (HR, ST, IBP, PLS, etCO$_2$, RRc, Rsp, Multigas)
A	Artifact (ECG, Rsp); Multigas Data Invalid
C	Blocked Line, Cuff Leak, Open Line, Overpressure (NBP)
F	Fault (SpO$_2$, PLS, NBP, Multigas)
L	Lead Off (ECG, Rsp, ST)
M	Failure to measure (NBP) ISO and ST measuring points changed
O	No pulsations (NBP)
U	Unplugged cable; loss of communication
X	Measurement time-out (NBP)
LRN	Learning (Rsp, ARR)
ON	Power up, patient admit, exit from Standby
STB	Standby
TST	System test
blank	No value (Respiration monitoring off, NBP between measurements, ST monitoring off, T over or under measurement range)

7 Recordings

Overview

You can connect a Dräger R50 Series 2-channel strip-chart recorder to the monitor in order to print out monitoring data, including trends and alarm data. If your monitor is part of the Infinity network, recordings can also be printed on a centrally located recorder or laser printer assigned to the bedside (see the section *Assigning Recorders*). In the Infinity network, you can request recordings remotely via the MULTIVIEW WORKSTATION (see the MVWS user's guide).

Recordings of waveforms are either timed or continuous and print at a recording speed of 25 mm/s. All recordings are identified by the patient's name, ID, and bed label as well as the date and time of the recording request.

If no recorder is available, the monitor automatically stores up to 10 recordings which you can later view, print, save, or delete via the Event Recall screen (see the section on *Event Recall*).

➤ **NOTE:** Trend recordings, OCRG recordings, and recordings of the Diagnostic Log cannot be stored.

You can request a recording manually by pressing the **Record** fixed key, or the monitor can trigger alarm recordings automatically for life-threatening alarms and limit violations, if the Record function is enabled on the Alarm Limits table (see the chapter *Alarms and Messages*).

The monitor displays recorder status and error messages to help you follow the progress of a recording or alert you to operational errors. For a list of these messages, see the message table at the end of this chapter.

Recorder Preparation

Connect the R50 Series recorder to the interface plate at the back of the monitor or to the Infinity Docking Station, if available.

⚠️ *CAUTION: Always place recorders and laser printers on a flat and stable surface to prevent them from falling.*

➤ **NOTES:**

- ■ The configuration/installation of a network laser printer is a Service function.

- ■ The function of the R50 recorder key **Alternate Speed** or **mm/s** is not supported by the Gamma Series monitor.

R50 Recorder Connection

R50 Recorder Connection

STEPS: Loading Paper

1. Press and release the top right button to open the paper door of the recorder.

2. Pull out the paper roll from the spool holder and any paper remaining in the printing mechanism.

3. Place a new paper roll into the spool holder. Unroll a few inches of paper from the bottom. The printed side should be facing up.

4. Align the paper roll with the paper guides. If not aligned, the paper could jam.

5. Close the paper door.

6. To verify proper connection and paper loading, generate a timed recording.

CAUTIONS:

■ *Use only the recording paper specified by Dräger. Use of other paper will result in unclear printing and damage to the printing head.*

■ *Store all paper in an environment that meets the recorder storage specifications listed in the "Technical Data" appendix. Failure to store paper properly can result in damage to the recorder.*

Assigning Network Recorders

For monitors connected to the Infinity network, you can choose a primary and secondary recorder/laser printer within the network. The monitor sends a recording request first to the primary recording device. If that device is busy or unavailable (i.e. out of paper), the monitor sends the request to the secondary recording device. If no recording device is available, the monitor stores the recording (see the section *Stored Recordings* in this chapter).

STEPS: Assigning Network Recording Devices

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Recordings**.

4. Click on **Primary Recorder**, select the desired recorder/ printer and click the knob again.

5. Click on **Secondary Recorder**, select a secondary recorder/ printer, if available, and click the knob again.

➤   **NOTES:**

- R50 Series recorders and laser printers in a wireless network are identified in the menu by the device label assigned to them during network configuration. Laser printers in a conventional network (monitor is docked at a Docking Station) are identified by the label LP.

- The Infinity network supports only one laser printer.

Recording Waveforms

To print real-time monitoring data, two types of recordings are available:

- Timed Recordings.
- Continuous Recordings.

For both recording types, the recording speed is 25 mm/s.

Timed and continuous recordings include up to two waveforms. If one of the waveforms is hidden by a menu, you can still request a recording. If a cascaded waveform is displayed, only the waveform from the first channel prints out.

➤ **NOTE:** Timed and continuous recordings cannot be started while the Alarm Limits table, trends or diagnostic logs are displayed. To start recording, exit those displays before requesting a recording.

Timed Recordings

Timed Recordings print a total of 20 seconds of patient data, of which about 10 seconds occurred prior to the recording request (Delay), and about 10 seconds after the recording request.

If no recorder/printer is available, the monitor stores the recording (see *Stored Recordings*, below). You can cancel the storage within 5 seconds of the initial recording request.

The monitor cancels a timed recording if you modify the display, size or scale of a waveform while the recording is ongoing.

STEPS: Starting a Timed Recording

1. Press the monitor's **Record** fixed key.
2. To cancel the recording, press the **Record** key again or the **Stop** key on the recorder while printing is in progress.

Continuous Recordings

Continuous recordings provide an up-to-the-second printout of patient data. This mode is useful when more than 20 seconds of data must be printed during critical, short-term applications.

➤ **NOTES:**

- You can request a continuous recording during an alarm, timed, trend, and diagnostic log recording. To do so, first stop the recording in progress with the Record fixed key on the monitor, then press and hold the same key to start the continuous recording.

- Continuous OCRG recordings are not supported.

STEPS: Starting a Continuous Recording

1. Press the **Record** fixed key for at least two seconds. Two beeps indicate when the recording starts.

2. To cancel the recording, press the **Record** fixed key again or the **Stop** key of the recorder while printing is in progress.

Continuous recordings cannot be stored. If you attempt to store a continuous recording, the monitor will store it as a timed recording with 20 seconds of patient data.

➤ **NOTES:**

- If the user requests a continuous recording **at the central station** while a timed recording is in progress, the timed recording is cancelled. A continuous recording can only be printed out if two recorders are available. If only one recorder is available, the continuous recording request is converted to a timed recording, then stored and printed when the recorder becomes available.

- An uninterrupted continuous recording on a laser printer consists of up to 120 pages.

Recording Formats

A timed or continuous recording consists of a header and two waveforms with proper scales, units of measure and parameter labels.
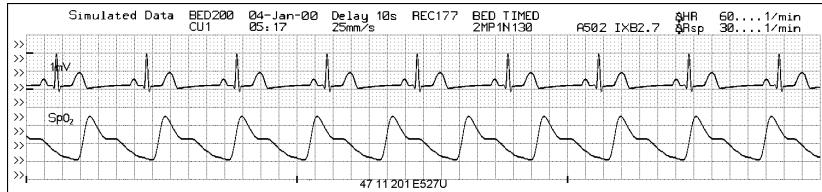
R50 Recording Strip
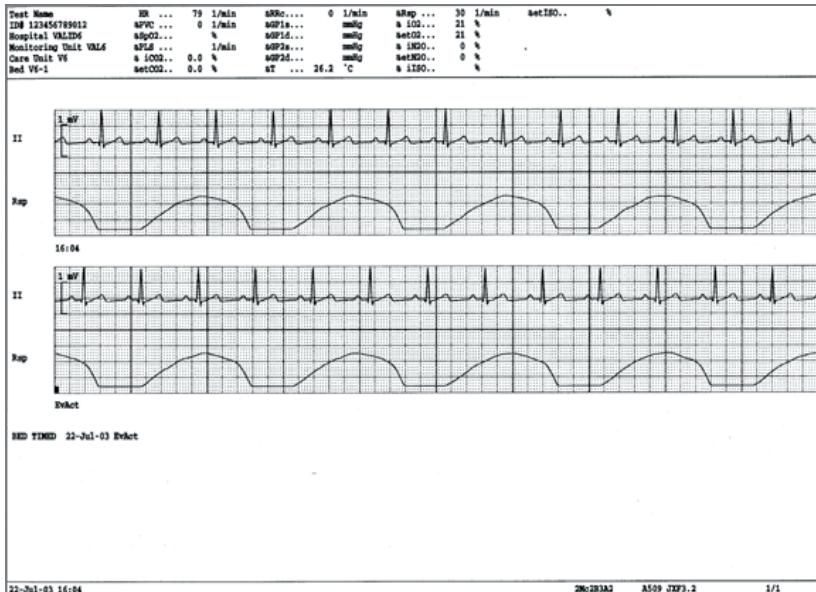
Printout of Laser Printer

The printout is identified by the following:

- Patient name and ID.
- Bed label and Care Unit.
- Date and time of the recording request.
- Recording delay and speed.
- Monitored parameters and values.
- Crossed bell symbol for parameters whose alarm is disabled.
- Recording mode (timed or continuous).
- *** or blanks if numeric values and waveforms are unavailable.

The printout shows the top two waveforms that were displayed on the monitor's screen at the time of the print request. A small black marker along the bottom of the printout indicates the time of the print request.

➤ **NOTES:**
- If the second waveform channel is set to Cascade, only the waveform in the first waveform channel prints out.
- OCRG recordings cannot be printed on a laser printer.

Recording Trends

Trend printouts are long-term records of heart rate and other patient vital signs. The printouts are snapshots of the tableor graphs as displayed when you press the **Record** fixed key on the monitor.

Trend parameters are printed in the order selected by the user. In addition, parameter trend data is printed only if valid trend data is available for that parameter in the tabular trend columns or in the graphical trend window.

You must view the graphical and tabular trends in order to record them. An alarm recording request preempts a trend recording.

In monitors that display Neonatal OCRG, the recorder prints 144 seconds of patient OCRG data that occurred prior to pressing the **Record** fixed key. The illustration below shows an OCRG recording strip.
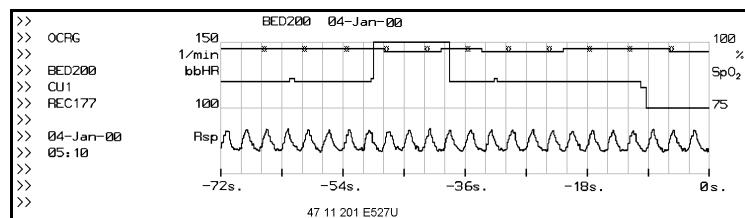
STEPS: Recording the Trend Table

1. Display the Trend Table.

2. Press the **Record** fixed key on the monitor. The illustration below shows a typical trend table recording strip.

```
>>
>>                           BED200    21-Mar-00
>>
>>                                     18:33   18:38   18:44   18:48   18:53   18:58
>>   BED200
>>                     HR     1/min      80      80      80      80      80      80
>>   CU1               SpO₂   %          97      96     *A*     *A*     *A*     *A*
>>   REC200            PLS    1/min      74      74      74      74      74      74
>>                     Rsp    1/min      20      20      20      20      20      20
>>   21-Mar-00         T      °F       102.0   102.0   102.0   102.0   103.1   103.2
>>
>>
>>            47 11 201 E52 U
```

STEPS: Recording Trend Graphs

1. Display the Trend Graph.

2. Press the **Record** fixed key on the monitor. The illustration below shows a typical trend graph recording strip.
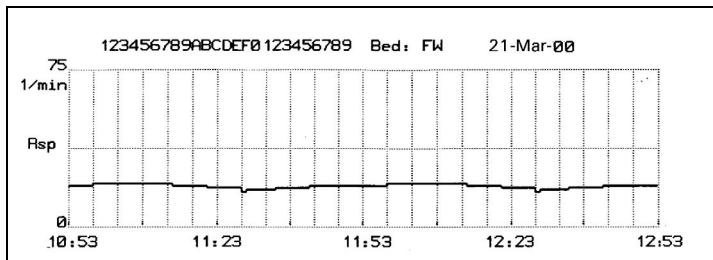
> **NOTE:** Because of the larger paper size, laser printers are best suited to print out trend data.

Recording Alarms

The monitor initiates a timed recording for life-threatening alarms and limit violations provided that:

- The parameter is being monitored.

- The parameter alarm is enabled.

- The parameter alarm recording is enabled.

- A recorder/printer is available.

Turn parameter alarms and alarm recordings on or off on the **Alarm Limits** or the **Arrhythmia Setup** tables (see the chapters *Alarms and Messages* and *Arrhythmia*).

Alarm recordings have priority over timed, trend, and diagnostic log recordings (e.g., if a trend recording is in progress, the monitor immediately cancel it to print the alarm recording instead).

➤ **NOTES:**

- The monitor prints a recording for life-threatening alarms even if the alarm recording function is turned off.

- Continuous recordings have priority over alarm recordings. Alarm recordings cannot be printed while continuous recordings are already in progress.

- Neonatal OCRG apnea alarm recordings print 144 seconds of patient data, consisting of 108 seconds of pre-event data and 36 seconds of post-event data.

The monitor cancels an alarm recording if you modify the display, size, or scale of a waveform during recording. You can also cancel an alarm recording by pressing the monitor's Record fixed key or the **Stop** key on the recorder. The monitor alerts you to a cancelled recording request by briefly displaying the message "*Recording Cancelled*."

If a cascaded waveform is displayed, the recording prints out only the top waveform. If a new alarm occurs while an earlier alarm is ready to print or the printing is in progress, the monitor finishes printing out the first alarm recording and **ignores the second alarm recording**.

Stored Recordings

The monitor can store up to 10 alarm or timed recordings consisting of 20 seconds of data each (about 10 seconds of pre-event/request data and about 10 seconds of post-event/request data.) Recordings are stored when:

■ No recorder/laser printer is available or if the recorder/laser printer is temporarily out of order (i.e. no recording paper).

■ You turned on the automatic storage of alarm recordings on the Alarm Limits table (see the chapter *Alarms and Messages*).

When the recording storage is full, the monitor deletes the oldest unsaved recordings as new recordings come in. You can view, print, save, and delete stored recordings via the Event Recall screen (see below).

Upon successfully storing a recording, the monitor emits 2 beeps. To cancel a recording storage in progress, press the **Record** fixed key on the monitor within 5 seconds of the start of the recording storage.

➤ **NOTE:** The monitor does not store continuous, trend, OCRG or diagnostic log recordings. Continuous recordings are converted to timed recordings and then stored.

Event Recall

You can view 4 seconds of waveform data for each stored recording on the Event Recall screen (4 seconds of pre-event/request data). The screen also shows the parameter values at the time of the recording storage.

To call up the Event Recall screen:

1. Press the **Menu** fixed key.

2. Click on **Review**.

3. Click on **Event Recall**.

➤ **NOTES:**

- You can also access the Event Recall screen via the Fast Access fixed key or by clicking on Monitor Setup > Recordings > Review in the Main Menu.

- The Event Recall screen shows only 4 seconds of data for each stored recording, although the monitor has actually stored 20 seconds of data for each stored recording. If you print the stored recording, the recording strip contains all 20 seconds of stored data.
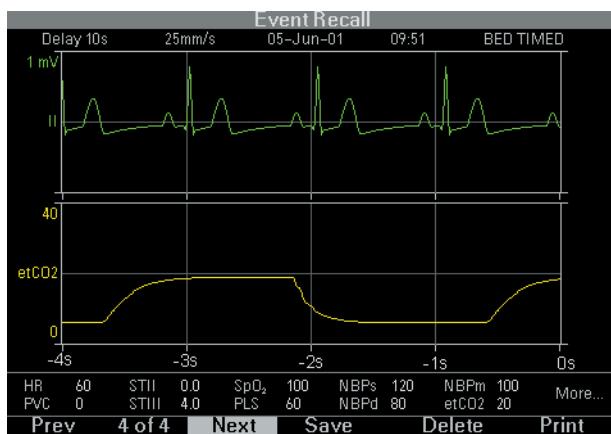
The Event Recall heading shows the amount of pre-event/request data (Delay, about 10 s), the recording speed, date and time of the recording, and the type of the recording (bedside timed or the parameter in alarm).

STEPS: Navigating the Event Recall Screen

1. Click on **Prev** to call up older stored recordings.

2. Click on **Next** to call up more recently stored recordings.

3. Click on **More...** next to the list of parameters to view additional parameters and their values at the time of the recording storage.

Saving, Printing, Deleting Stored Recordings

You can save, print or delete stored recordings via the Event Recall screen. The monitor allows you to permanently save up to 9 stored recordings. A saved recording cannot be deleted and it is marked by a padlock icon.

STEPS: Saving a Stored Recording

1. Call up the Event Recall screen.

2. Click on **Prev** or **Next** to select a stored recording.

3. Click on **Save** (click on Save again, to unlock the saved recording).

STEPS: Printing or Deleting a Stored Recording

1. Call up the Event Recall screen.

2. Click on **Prev** or **Next** to select a stored recording.

3. Click on **Print** or **Delete**.

➤ **NOTE:** You can only delete a saved recording, if you first unlock it by clicking on **Save** again.

Recording Status Messages

The monitor displays messages during a recording to help you follow the progress of a recording and to alert you to any operational errors.

Message	Possible Cause
Recorder Door Open	Close door to obtain recordings.
Recorder Failure	Recorder error; call your Biomed.
	Excessive artifact in the waveforms; the recorder does not have sufficient power to print the recording.
Check Printer	Printer error: Laser printer connection lost, printer out of paper or tray open.
Recorder Out of Paper	Load paper to obtain recordings.
Recording Cancelled	The recording has been cancelled following a user's request. Wait for the message to clear to request another recording.
Recording Finished	The recording is printed. Another recording can be initiated.
Recording Started	Recording in progress. Wait for the recording message to clear before requesting another recording.
Recording Stored	The recording has been stored.
<#> Stored Recording(s)	Indicates number of stored recordings.

8 ECG and Heart Rate

Overview

The monitor can:

- Display one or two ECG leads.

- Calculate the average heart rate per minute.

- Identify a number of arrhythmia events, including asystole, ventricular fibrillation, bradycardia, and ventricular tachycardia (see the chapter *Arrhythmia*).

- Analyze ST segment deviations for the displayed ECG leads (option -- see the chapter *ST-Segment Analysis*).

Electrodes applied to the patient's chest pick up the electrical impulses initiated by the heart. The monitor amplifies these electrical signals and displays them on the screen.

The monitor accepts 3, 5, and 6-lead ECG cable sets. With a 3-lead set you can monitor the leads I, II, and III. With a 5-lead set you can monitor the leads I, II, III, aVR, aVL, aVF and V (chest). With a 6-lead set you can monitor the leads I, II, III, aVR, aVL, aVF, V (chest) and V+ (additional chest).

When you first turn on the monitor, it calculates heart rate within 15 seconds or 3 beats, whichever is longer, and displays the value in the HR parameter box. Thereafter, the heart rate is updated after every detected beat. The heart symbol ♥ pulsates with every detected QRS complex. When the HR alarm is turned off, a crossed bell appears beside the HR value. When monitoring a paced patient, the letter "P" is added to the heart symbol.

➤ **NOTE:** If voltage to the monitored ECG lead(s) is too high, the waveform goes blank until the input voltage returns to a range that can be monitored.

Patient Preparation

Selecting and Preparing the Electrodes

There is a wide selection of reusable and prepackaged, pre-gelled, and disposable electrodes to choose from.

Always select the best electrode for your particular monitoring situation. Because of their stability, the use of Ag/AgCl reusable or disposable electrodes is recommended.

If using reusable electrodes, place a ¼ to ½ inch (½ to 1 cm) of conductive gel in the spacer before application and attach the electrodes to the skin with an adhesive ring.

If using pre-gelled electrodes, verify that there is enough gel in the gel-filled area. Never use disposable electrodes after their expiration dates or when the gel has dried out.

Preparing the Patient's Skin

STOP

WARNING: Conductive parts of electrodes and connectors (including the neutral electrode) should not contact other conductive material, including earth.

The quality of ECG monitoring depends largely on the strength and quality of the signals received by the electrodes. Careful skin preparation and application techniques assure strong signals with minimal artifact and interference.

Select flat, non-muscular sites to position the electrodes and follow the clinical techniques of your hospital. We suggest the following standard technique:

1. Prepare the skin by clipping or shaving excess hair.

2. Remove any skin residue or oils with an alcohol pad.

3. Remove the outer epidermal layer as required to reduce skin impedance. Mildly abrade only the electrode contact site with ultrafine sandpaper (220-400 grit). Apply the electrodes one at a time and make sure the electrode gel is in contact with the abraded skin area.

4. For severely diaphoretic patients, use a benzoin prep for tighter adherence of the electrodes.

5. Inspect the electrode gel to make sure it is moist. Apply the pad with a circular motion on the adhesive area first, then press gently on the gel area to prevent the gel from being squeezed out.

6. Change electrodes every 24-48 hours to ensure a good quality signal. However, if the electrocardiographic pattern becomes less distinct, if the patient is diaphoretic, or if skin irritation develops, the electrodes must be changed and reapplied sooner.

Positioning the Electrodes

Position the electrodes on the chest at locations that provide the clearest and most informative electrocardiogram for each patient. The following table identifies each lead and its associated color for the IEC 2 (AHA/US) and IEC 1 color schemes.

Lead	IEC 2 (AHA/US)	IEC 1
LL	Red	Green
RL	Green	Black
LA	Black	Yellow
RA	White	Red
V	Brown	White
V+	Gray and White	Gray and White

The following pictures show possible configurations of 3-, 5-, and 6-lead electrode sets. Note that these configurations are examples only; final configuration must be determined by a trained clinical personnel.

3-Lead Standard Configuration
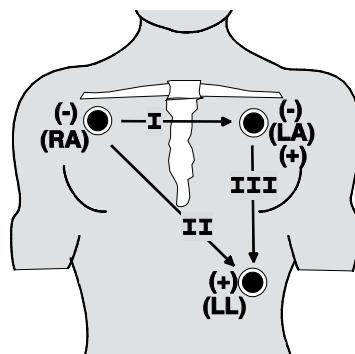
3-Lead MCL1 Configuration

➤ **NOTE:** Select ECG I in the waveform channel for monitoring the MCL1 configuration.
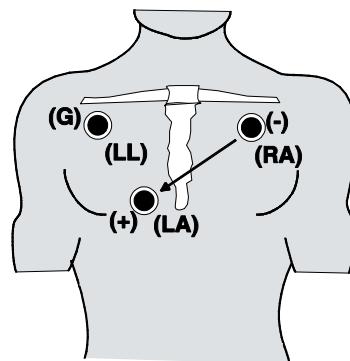
5-Lead Standard Configuration
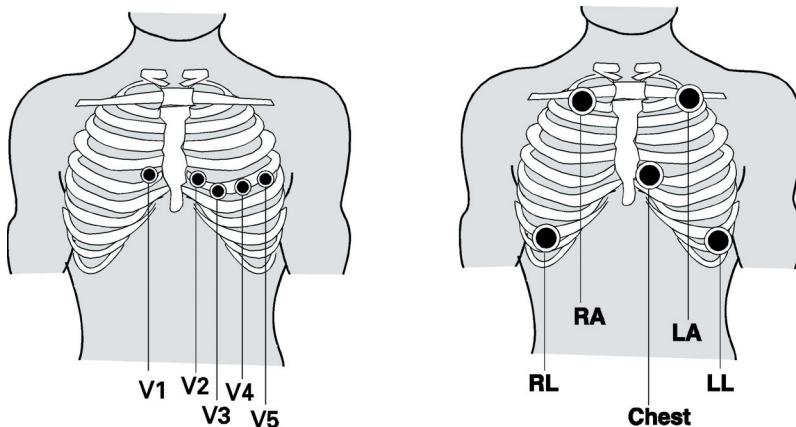
6-Lead Standard Configuration
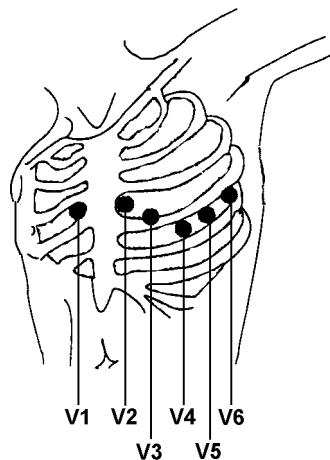
3-Lead Configuration for Neonates

When monitoring neonates, the use of a 3-lead configuration is recommended. Dräger also recommends use of the NEOMED™ Pod for neonates. Position the right arm (RA), left arm (LA) and left leg (LL) electrodes as illustrated below.
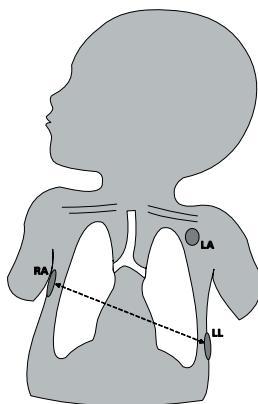
ECG Monitoring Settings

Cable Type

This option lets you select the number of leads connected to your patient. This is particularly important when monitoring with a 5- or 6-lead cable set to ensure the proper detection and display of augmented leads.

➤ **NOTE:** If an augmented lead was displayed when switching from a 5-lead or 6-lead cable to a 3-lead cable set, the monitor defaults to the display of lead II. This ensures the display of an ECG when switching cable types.

S*TEPS: Selecting the Cable Type*

1. Click on the **HR** parameter box.

2. Click on **More...**.

3. Click on **ECG Leads**.

HR Setup	
ECG Processing	ECG1&2
ECG Leads	5
Arrhythmia	Basic
Relearn	05Jun01 08:31
More...	
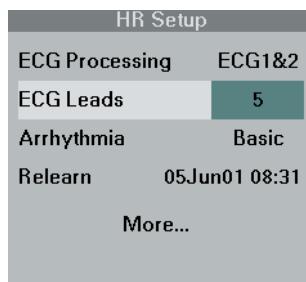
4. Dial in the desired cable type and click the knob.

Lead Selection and Display Amplitude

Select the lead(s) that provides the clearest and most informative electrocardiogram for your patient. The **Size** selection lets you modify the amplitude of the displayed ECG for optimum viewing. The available ECG sizes are:

■ 0.25, 0.5, 1, 2, 4, and 8 mV/cm.

STEPS: Selecting the Lead and Size

1. Click on the waveform channel where the ECG waveform is currently displayed.

2. Click on **Waveform**.

3. Select the desired ECG lead and click the knob.

4. Click on **Size**.

5. Select the desired display amplitude and click the knob.

➤ **NOTES:**

■ The lead assigned to the first waveform channel cannot be assigned to the second waveform channel, except in Cascade mode.

■ If you change the monitor's leads and the MULTIVIEW WORKSTATION is storing waveforms selected manually (Auto Track OFF), you must also change the leads at the MULTIVIEW WORKSTATION. For more information, see the MULTIVIEW WORKSTATION's user guide.

Cascade Display

The electrocardiogram displayed in the first channel is about four seconds long. To display eight seconds of the same waveform, select the cascade mode. Cascade mode continues the display of the first waveform channel into the second channel.
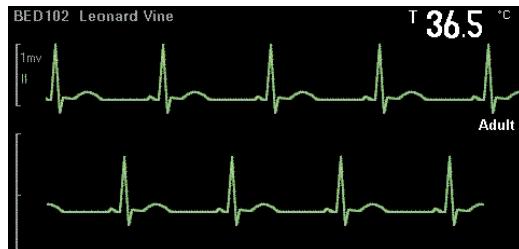
➤ **NOTES:**

- The Cascade is only available in the second waveform channel. If etCO2, IBP2 and ST are enabled, the ECG cascade is not available.

- The second channel of a cascaded waveform cannot be printed on recordings.

STEPS: Selecting the Cascade Display

1. Click on the **second** waveform channel.

2. Click on **Waveform**.

3. Select **Cascade** and click the knob.

➤ **NOTE:** You cannot adjust the display amplitude (Size) for the second waveform channel when Cascade is selected; the amplitude is the same as the one in the first channel.

One- or Two-Channel Signal Processing

The monitor can process one or two ECG leads. If you select two-channel signal processing, ECG and arrhythmia monitoring is less vulnerable to artifact, because the monitor can assign a greater weight to the "cleaner" channel or even exclude a channel from signal processing altogether, if it exceeds a certain level of artifact. In this case, ECG monitoring continues without interruption, unless both channels start showing excessive artifact.

The monitor processes the two leads displayed in the top two waveform channels. If no lead or only one lead is currently displayed in these channels, the monitor uses the last leads previously displayed there.

➤ **NOTE:** When you call up the second page of the HR Setup menu by clicking on **More...** (see below), the two ECG leads available for signal processing appear to the right of the menu. To change these leads, exit the HR Setup menu, click on waveform channel 1 or 2, and select a different ECG lead for display.

STEPS: Selecting One- or Two-Channel Signal Processing

1. Click on the **HR** parameter box.

2. Click on **More...**.

3. Click on **ECG Processing**.
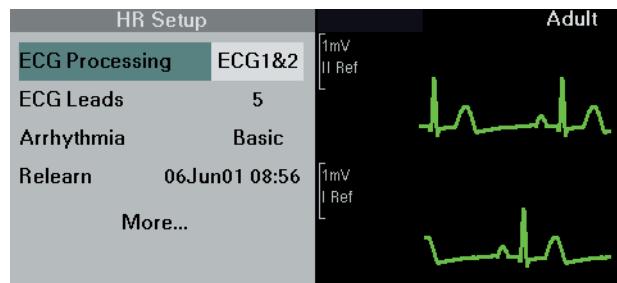
4. Select the desired setting (**ECG1** or **ECG1&2**) and click the knob.

Pulse Tone Source

You can select either ECG or SpO_2 as the pulse tone source. With
ECG as the pulse tone source, the tone's pitch is constant (rather
than modulated -- see the chapter *Pulse Oximetry*) and a pulsating
♥ symbol appears in the HR parameter box with each detected
heart beat.

STEPS: Selecting the Pulse Tone Source

1. Click on the **HR** parameter box.

2. Click on **Tone Source**.

HR Setup	
Tone Source	ECG
Tone Volume	OFF
Pacer Detect	OFF
QRS Marks	OFF
Arrhythmia Setup	⬜
More...	
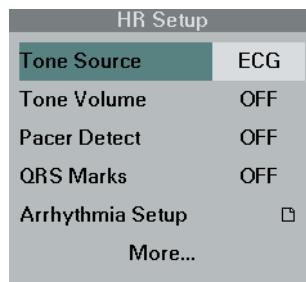
3. Select **ECG** and click the knob.

Pulse Tone Volume

When ECG is selected as the pulse tone source, the monitor emits a tone every time it detects a QRS complex. You can adjust this tone volume and choose one of the following settings:

■ High, Medium, Low, and OFF.

➤ **NOTES:**

■ Tone volume settings are common to both ECG and SpO_2 source signals. Whatever setting you select for ECG is valid for SpO_2 and vice-versa.

■ The monitor's Master Speaker Volume (see the chapter *Monitor Setup*) determines the volume of all tones. If you select a pulse tone volume higher than that of the speaker volume, the pulse tone volume sounds only at the level of the speaker volume. If you select a lower setting for the pulse tone, the pulse tone sounds at the volume selected.

STEPS: Setting the Pulse Tone Volume

1. Click on the **HR** parameter box.

2. Click on **Tone Volume**.

HR Setup	
Tone Source	ECG
Tone Volume	Medium
Pacer Detect	OFF
QRS Marks	OFF
Arrhythmia Setup	▯
More...	
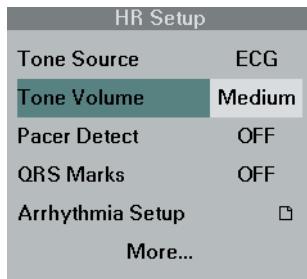
3. Select the desired setting and click the knob.

Pacer Detection

Pacer detection is used for paced patients in the adult and pediatric monitoring modes. The monitor detects paced pulses in the amplitude range of ±5 to ±700 mV. When pacer detection is enabled, the letter "P" is added to the flashing ♥ symbol in the HR parameter box for each paced beat. In addition, green positive spikes on the ECG waveform indicate pacemaker pulses.

When monitoring paced patients, Dräger suggests the following:

- ■ Use the electrode positions that are best suited for paced patients (see the electrode placement section).

- ■ Select the lead with the highest R-wave.

- ■ Follow the pacemaker precautions given at the end of this section (see *ECG and HR Safety Considerations*).

STEPS: Turning Pacer Detection ON/OFF

1. Select the **HR** parameter box and click the knob.

2. Click on **Pacer Detect**.

HR Setup	
Tone Source	ECG
Tone Volume	OFF
Pacer Detect	ON
QRS Marks	OFF
Arrhythmia Setup	▯
More...	

3. Dial in the desired setting (**ON/OFF**) and click the knob.

➤ **NOTE:** The monitor indicates **Pacer Off** between the first two waveform channels when pacer detection is set to Off.

Displaying Sync Marks

The timing of the sync pulse triggered by the QRS complex can vary slightly. You can display sync marks on the R-wave of the electrocardiogram to verify the timing of the pulse.

The monitor displays sync marks as a white line during synchronization. For heart rates between 30 and 250 beats per minute with QRS amplitudes greater than or equal to 0.5 mV, the sync pulse occurs within 35 ms of the R-wave peak. See the section *ECG and HR Safety Considerations* for details.

➤ **NOTE:** If SpO$_2$ is displayed in the first channel and ECG in the second channel, no QRS markers appear on the ECG.

STEPS: Displaying QRS Sync Marks

1. Click on the **HR** parameter box.

2. Click on **QRS Marks**.

HR Setup	
Tone Source	ECG
Tone Volume	OFF
Pacer Detect	ON
QRS Marks	ON
Arrhythmia Setup	🗋
More...	
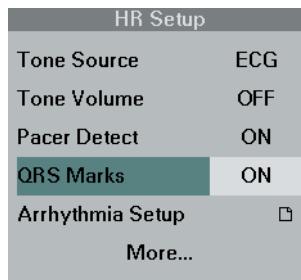
3. Dial in the desired setting (**ON/OFF**) and click the knob.

ECG and HR Safety Considerations

HR Alarm Settings

Set HR alarm limits on the Alarm Limits table (see the chapter *Alarms and Messages*). If you turn the HR alarm off, the monitor displays a crossed bell icon in the HR parameter box and the banner **HR Alarms Off** appears above the first waveform channel.

STOP   **WARNING: If an asystole or ventricular fibrillation occurs while the HR alarm *and* arrhythmia monitoring is turned off, the monitor does not alarm for these life-threatening events.**

Neonatal ECG Monitoring

To obtain the most accurate heart rate count and waveform display, select the ECG lead(s) with the smallest T wave and the largest monophasic QRS.

STOP   **WARNING: Neonatal QRS complexes that are biphasic and less than 40 ms wide, or monophasic and less than 20 ms wide, are displayed smaller than their actual amplitude.**

ECG 50/60 Hz Notch Filter Setting

When the line frequency is set incorrectly, the resulting 50 or 60 Hz noise on the ECG signal can make the ECG waveform unreadable along with masking QRS complexes. As a result, detection of the QRS complexes becomes unreliable. When these cannot be sensed reliably, incorrect HR calculations may result, leading to both false positive and false negative HR alarms.

Muscle Stimulators

STOP   **WARNING: The use of electrical muscle stimulators may interfere with ECG and respiration monitoring. If this occurs, discontinue their use.**

Electrosurgery (ESU)

The monitor's ECG function is protected against high-frequency interference from defibrillators and electrosurgical units. The ESU BLOCK (optional) enhances the performance of the monitor during electrosurgery and allows you to use standard ECG leads. It reduces noise on ECG tracings and helps protect the patient from burns.
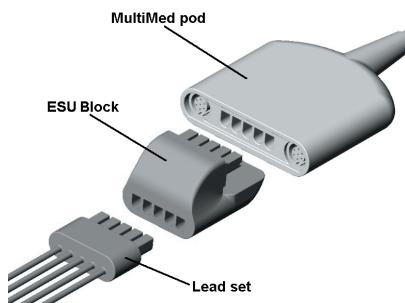
STEPS: Using the ESU Block

1. Turn off pacemaker detection.

2. Plug the ESU block into the MULTIMED 5 pod as shown above. If you are using a MULTIMED 6 pod, ignore the extra V lead connection.

3. Plug a standard white ECG lead set into the ESU block as shown. Do not use shielded blue leads with the ESU block.

4. Remove the ESU block to continuously monitor the patient.

WARNINGS:

- **Dräger recommends using the ESU block during electrosurgery. If you do not have an ESU block, use only Dräger blue ECG lead wires. They help protect the patient from burns caused by ESU-induced current flowing through the leads.**

- **Impedance respiration monitoring and pacemaker spike detection are inoperative when using the ESU block.**

- **The NEOMED pod is not intended for use during electrosurgery. To protect patients from burns, do not use the NEOMED pod in an ESU environment.**

To minimize interference from ESUs, we recommend the following:

- Place the electrodes as far from the surgical incision as possible while maintaining a clinically useful configuration.

- Place the cable and lead wires as far from the ESU as possible and perpendicular to the ESU cables.

- Use an ESU neutral electrode with the largest possible contact area.

- When possible, place the ESU neutral electrode close to and directly under the surgical site, avoiding bony protuberances.

- Replace the electrodes at regular intervals.

- Read the instructions provided with the ESU for additional information.

- For patients without a pacemaker, turn the pacer detection off. If pacer detection is on, the ESU interference may be detected as pacer spikes that will display on the ECG.

The ECG waveform(s) and the HR value may be affected during electrosurgery. However, after discontinuing the use of electrosurgery equipment, the waveform(s) and value will be displayed as normal.

Infusion pumps

Use of an infusion pump may cause artifact in ECG signals. To determine if the pump is the source of electrical interference in the signal, turn it off, if possible. If the artifact disappears, it was probably caused by the pump.

To minimize artifact and improve the signal, try the following:

- Choose ECG lead(s) with the best signal for monitoring or replace the electrodes.
- Keep ECG cables away from the infusion pump and its wiring.

Defibrillators and Cardioversion

WARNINGS:

- **Before attempting a cardioversion, verify the timing of the sync pulse on your monitor.**
- **Never place the defibrillator paddles over the ECG electrodes or cables. The discharge can burn the patient or the clinician, or fibrillate the clinician and not defibrillate the patient.**

High P-Waves and T-Waves

WARNING: The monitor may count high amplitude P or T-waves (>0.2 mV) of long duration as QRS complexes. This can result in missed low-rate alarms. If the displayed heart rate (HR) is higher than that indicated by the waveform, the monitor may be counting unusually high T-waves or P-waves as QRS complexes.

To obtain the most accurate heart rate count, do the following:

- Follow the steps outlined for pacemaker patients, selecting the lead with the highest R-wave relative to the T-wave and the P-waves or both.

- If inaccurate counting continues, reposition the electrodes until you obtain an acceptable waveform. In addition, Dräger recommends monitoring the heart rate for these patients with an SpO_2 sensor.

Pacemakers

Take special care in the evaluation of ECG waveforms.

WARNING: In case of uncertainty regarding the interpretation of QRS complexes, the monitor is designed to err in the direction of false positive rather than false negative alarms. In paced patients, QRS complexes may not be counted, resulting in false low-rate alarms under the following circumstances:

- **Fused beats and asynchronous pacers when coupling intervals are +10 to –90 ms.**

- **700 mV pacer pulses followed by QRS complexes smaller than 0.5 mV.**

- **Asynchronous pacer pulses with overshoot.**

The monitor successfully passed the pacer pulse rejection test. However, it is not possible to anticipate every waveform characteristic.

WARNING: The monitor may not count heart rates accurately and may misinterpret rate-dependent arrhythmia in some paced patients. Do not rely entirely on the displayed heart rate to assess a paced patient's condition. Always observe these patients closely and monitor all of their vital signs carefully.

AV Sequential or DDD Pacemakers

For pacemaker patients, follow these steps:

- Always attach at least four electrodes to allow for a choice of leads.

- Turn pacer detection on.

- Select the lead with the highest R-wave and the least interference.

- Verify that the HR calculation is accurate by comparing it to the ECG waveform.

- Monitor the pulse or the respiration or both using a method other than ECG.

For patients without pacemakers, turn the pacer detection off.

Pacemakers with Impedance-Derived Rate Response

These pacemakers emit pulses for the purpose of adjusting the pacer rate to the patient's respiration rate. The monitor may classify such impedance spikes as pacer spikes and display them in very short, regular intervals superimposed on the patient's ECG. For patients with pacemakers, change the electrode placement until the impedance spikes shrink in size or disappear.

Large Amplitude Pacer Pulses

WARNING: Some pacemakers, especially external pacemakers, emit pulses with amplitudes far exceeding those shown in the pacer pulse rejection table. The monitor may misinterpret such pulses as valid QRS complexes and may fail to detect cardiac arrest.

Transcutaneous Electrical Nerve Stimulators (TENS)

TENS signals are similar to pacemaker spike signals and may be accidentally labeled as such by the monitor.

WARNING: Valid QRS complexes following mislabeled TENS signals could be rejected. The result may be false asystole or low heart rate alarms. If TENS signals continue to be interpreted as pacer spikes, turn the pacer detection off.

9 Arrhythmia

Arrhythmia Classification Expert (ACE)

The Infinity Gamma Series monitor uses Dräger's ACE ™ (Arrhythmia Classification Expert) technology to screen out misleading or erroneous arrhythmia information. ACE is not rule-based; it uses trained logic to draw informed conclusions about the patient. This provides correct detection of legitimate cardiac events while reducing the likelihood of false alarms.

Overview

Arrhythmia monitoring is available for adult and pediatric patients. The arrhythmia monitoring mode you select (Basic, Full, or OFF) determines which kinds of arrhythmia events the monitor detects (see table below).

➤ **NOTES:**

- Full arrhythmia monitoring is available as an option and must be enabled by your Biomed.

- Arrhythmia monitoring is not available for neonates.

When you turn arrhythmia monitoring on, the monitor passes through a learning phase (30 to 40 seconds) in which it learns the patient's dominant QRS pattern and stores it for reference. Subsequent beats and QRS rhythms are then compared to the stored reference and classified as either normal or irregular (arrhythmia).

During the learning phase, *LRN* appears in the HR parameter box and the message *Arrhythmia Relearning* in the message area at the bottom of the screen. You can also initiate a learning phase manually at any time (see the section *Relearning a Patient's ECG*, below). Date and time of the last learning phase are indicated in the HR Setup menu.

HR Setup	
ECG Processing	ECG1&2
ECG Leads	5
Arrhythmia	Full
Relearn	06Jun01 15:52
More...	
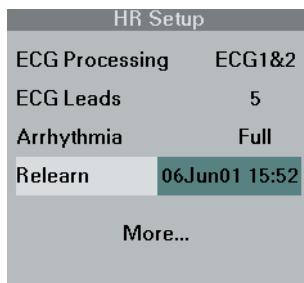
➤ **NOTE:** For arrhythmia monitoring, the monitor processes the leads selected for ECG monitoring (see the chapter *ECG and Heart Rate*).

Arrhythmia Monitoring Modes

Label	Event	Description
OFF: The monitor detects these events when Arrhythmia = OFF (via ECG)		
ASY	Asystole	4 seconds pass without the detection of a valid QRS complex
VF	Ventricular Fibrillation	The monitor identifies a sinusoidal waveform with fibrillation characteristics
Basic: The monitor detects these additional events when Arrhythmia = Basic		
VT	Ventricular Tachycardia	N* or more consecutive PVCs with a beat-to-beat rate >= the VT rate
BRDY**	Sinus Bradycardia	8 or more consecutive normal beats with an average rate <= the BRDY rate
Full: The monitor detects these additional events when Arrhythmia = Full		
RUN	Ventricular Run	3 to N-1* consecutive PVCs with a beat-to-beat rate >= the VT rate
AIVR	Accelerated Idioventricular Rhythm	3 or more PVCs with a rate < the VT rate
SVT	Supraventricular Tachycardia	N* or more consecutive normal beats with a beat-to-beat rate >= the SVT rate
CPT	Ventricular Couplet	A sequence of beats with the pattern: normal, PVC, PVC, normal
BGM	Ventricular Bigeminy	A sequence of beats with the pattern: normal, PVC, normal, PVC, normal
TACH	Sinus Tachycardia	N* or more consecutive normal beats with a beat-to-beat rate >= the TACH rate
PAUS	Pause	A sequence of two normal beats with an N-N* interval > the Pause rate times the average N-N interval (±100ms)
ARTF	Artifact	A sinusoidal signal with a frequency of 10 to 20 Hz and an amplitude > 0.4 mV p-p, or with a frequency of 0.25 to 10 Hz and an amplitude > 10 mV p-p

*   N is the event count set on the Arrhythmia Setup Table.

**   In neonatal mode, you can set alarm limits for BRDY in the Alarm Limits table and the monitor alarms upon a limit violation for this event.

Turning Arrhythmia Monitoring ON

STEPS: Turning Arrhythmia Monitoring On/Off

1. Click on the **HR** parameter box.

2. Click on **More...**.
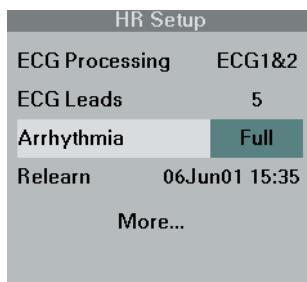
3. Click on **Arrhythmia**.

4. Select the desired setting (**Basic**, **Full**, **OFF**) and click the knob.

➤ **NOTES:**

- If a continuous recording is in progress when you turn arrhythmia monitoring on, printing stops and the recording is canceled.

- When the monitor detects a baseline shift, arrhythmia monitoring is suspended temporarily and resumes 35 seconds after the last detection of the baseline shift.

When you turn arrhythmia monitoring on, the monitor displays the PVC rate in the HR parameter box. If the monitor detects an arrhythmia event, it displays the label of the event and an alarm message in the message area at the bottom of the screen.
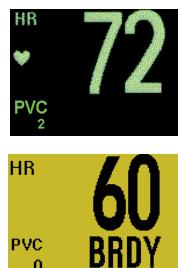
Arrhythmia Setup

The Arrhythmia Setup table lets you set Rate and Count limits for certain arrhythmia parameters and turn alarms and alarm recordings on or off. Call up the Arrhythmia Setup table as follows:

1. Click on the **HR** parameter box.

2. Click on **Arrhythmia Setup**.

Arrhythmia Setup				
▼ ▲	Rate	Count	Alarm	Record
ASY			ON	Str/Rec
VF			ON	Str/Rec
VT	>=120	>=10	ON	Record
BRDY	<=50		ON	Store
RUN	>=120	3–9	ON	Store
AIVR	<=119	>=3	🔕	OFF
SVT	>=150	>=3	🔕	OFF
CPT			🔕	OFF

When you turn full arrhythmia monitoring on, the Arrhythmia Setup table spans 2 pages. Click on one of the arrow keys in the upper left-hand corner to view additional parameters.

➤ **NOTE:** Alarm settings for PVC can be selected in the Alarm Limits table (see the chapter *Alarms and Messages*).

Rate and Count

STEPS: Selecting Rate and Count Limits

1. Call up the **Arrhythmia Setup** table (see above).

2. Click on the limit in the **Rate** or **Count** column for the desired arrhythmia parameter.

3. Dial in the desired limit and click the knob.

➤ **NOTE:** You can change limits only for VT, BRDY (rate only), SVT, TACH, and PAUS (rate only). The displayed limits for RUN and AIVR are informational.

Arrhythmia Alarms

STEPS: Turning Arrhythmia Alarms On/Off

1. Call up the **Arrhythmia Setup** table (see above).

2. Click on the alarm setting in the **Alarm** column of the desired arrhythmia parameter.

3. Dial in the desired setting (**ON/OFF** ⌀) and click the knob.

➤ **NOTE:** You cannot turn the alarms for asystole (ASY) and ventricular fibrillation (VF) off.

🛑 **WARNING: Certain ventricular tachycardia (VT) have sinusoidal waveforms closely resembling those of ventricular fibrillation (VF). Because of the similarity of these waveforms, the monitor may classify such types of ventricular tachycardia as ventricular fibrillation, the more serious of the two conditions.**

Arrhythmia Alarm Recordings

STEPS: Turning Alarm Recordings On/Off

1. Call up the **Arrhythmia Setup** table (see above).

2. Click on the recording setting in the **Record** column of the desired arrhythmia parameter.

3. Dial in the desired setting (**Record**, **Store**, **Str/Rec**, or **OFF**).

➤ **NOTES:**

  ■ You cannot turn alarm recordings for asystole (ASY) and ventricular fibrillation (VF) off. For these events, only the settings **Record** and **Str/Rec** are available.

  ■ See the chapter *Recordings* for a description of alarm and stored recordings and how to view, save, print, or delete stored recordings via the Event Recall screen.

Relearning a Patient's ECG

It is advisable to initiate a relearning under one or more of the following conditions:

■ Eight hours have passed since the last learning of a reference complex.

■ You repositioned the electrodes.

■ You observe clinically questionable arrhythmia calls.

■ There have been significant changes in the patient's ECG.

■ The message *ARR Relearn* appears in the message area.

The monitor automatically relearns in the following cases:

■ When you turn arrhythmia monitoring on or change between basic and full arrhythmia monitoring.

■ When you change the displayed ECG leads while arrhythmia monitoring is on.

STEPS: Relearning the Patient's ECG

1. Make sure that the ECG leads are properly connected and that the ECG displayed seems normal for this patient.

2. Click on the **HR** parameter box.

3. Click on **More...**.

4. Click on **Relearn**.

HR Setup	
ECG Processing	ECG1&2
ECG Leads	5
Arrhythmia	Full
Relearn	06Jun01 15:52
	More...
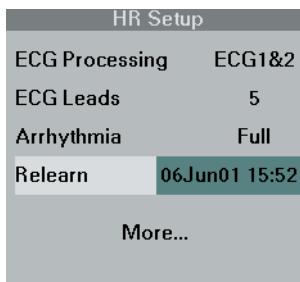
NOTE: You cannot initiate a relearning, if arrhythmia monitoring is turned off.

During the learning phase, *LRN* appears in the HR parameter box and the message *Arrhythmia Relearning* in the message area at the bottom of the screen. Once learning is complete, date and time of the learning phase are displayed in the HR Setup menu next to the Relearn selection.

10 ST Segment Analysis

Overview

The monitor provides an option for ST segment analysis, available for the adult and pediatric monitoring modes. When activated, this option analyzes the patient's normal QRS pattern and determines values for ST segment deviation (i.e., how far the ST segment of the QRS complex is above or below the isoelectric line). ST segment analysis is performed on the two leads selected for ECG monitoring. The default leads for ST analysis are lead II and V (with a 5- or 6-lead cable), the same default leads assigned for Arrhythmia monitoring. Upper and lower limits are user-selectable and the monitor triggers an alarm in case of limit violation.

When you connect the monitor to a patient, the monitor begins the process of learning the patient's dominant ECG beat pattern: this pattern serves as a baseline for determining subsequent normal beats. The monitor stores an average ST complex that is derived from those beats classified as normal. In order to obtain an ST segment deviation value, the monitor then compares the isoelectric and the ST segment level of the average complex. The ST segment deviation represents the difference in voltage between the isoelectric and the ST segment level of the average complex. The monitor displays the ST segment deviation in the ST parameter box. The value is updated every 15 seconds.

➤ **NOTES:**

■ You can initiate a Relearn of the ECG reference pattern manually at any time (see the chapter *Arrhythmia*).

■ ST deviation values are displayed in mm (default) or mV. Changing the units of measurement is a password-protected function. For information, contact your Biomedical personnel.

■ In OR mode (see the chapter *Multigas*), the ST parameter box is not displayed and deviations in the ST segment are neither monitored nor trended.

🛑 **WARNING: The ST algorithm has been tested for the accuracy of detecting ST segment deviations. The significance of the ST segment deviations must be determined by a clinician.**

ST Monitoring Display

The monitor performs the ST segment analysis on the two leads selected for ECG monitoring. If the ECG leads monitored are not currently displayed, the monitor processes the signal on the last ECG lead(s) selected. When the ST option is enabled, and the monitor is set for adult or pediatric monitoring mode, the ST1 and ST2 values are continuously displayed in the ST parameter box. However, the number of ST leads displayed changes according to the ECG lead configuration selected. With a 3-lead monitoring configuration, for example, the ST parameter box shows only one ST value. Configurations with more than 3 leads produce ST1 and ST2 values, even if only one ECG waveform is displayed on screen.

If the first and second waveform channels display ECG leads, the ST parameter box appears next to the second waveform channel. If only the first waveform channel displays an ECG lead, the ST parameter box appears at the bottom of the screen.

If ST1 or ST2 alarm limits are disabled, a crossed bell appears next to the corresponding ST value. When ST alarms are on and an ST value goes above or below the user-defined limits, the ST parameter box flashes and the alarm message appears at the bottom of the display. If the monitor detects another alarm simultaneously (for example, an ST and an SpO_2 alarm), it reports both events (see the chapter *Alarms and Messages* for details).

When you change an ST lead and it is no longer displayed on screen, the trended values for the old lead stay in the trend memory.

➤ **NOTE:** When the monitor uses the Export Protocol to communicate with an external device, ST values are rounded to the nearest millimeter (or millivolt) and transmitted as whole numbers. For example, a value of 1.7 mm is transmitted as 2 mm.

ST Setup

Call up the ST Setup menu by clicking on the ST parameter box.
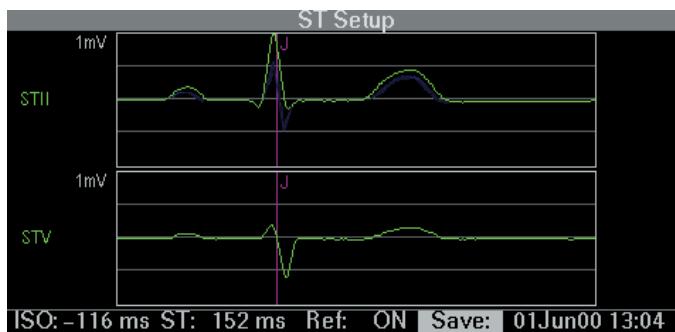
For **each** ST lead selected, the ST Setup menu displays the following:

- **ST Segment Waveform** — Includes the last averaged QRS complex. The label and scale of the ST waveform appear on the left side of the waveform. The waveform scale is the same scale used for the ECG lead displayed on the main screen.

- **Position of Isoelectric and ST Measurement Points** — Allow the clinician to display and set the isoelectric and ST measurement points in relation to the beginning and end of the QRS complex, respectively. When you click on **ISO** or **ST**, the location of the isoelectric and measuring points is indicated by vertical lines on the ST1 and ST2 waveforms. Numerical values at the bottom and on the right side of the waveforms further define the location of these two points (in milliseconds or millimeters/millivolts).

- **Ref(erence)** — Displays or hides the ST reference complex, a purple waveform obtained by saving the currently displayed ST waveform.

- **Save** — Saves and time-stamps the currently displayed ST waveform as a reference waveform. As new values are captured, the real-time ST segment waveform overlaps the reference waveform to show changes in the ST segment.

Isoelectric and ST Measuring Points

ST segment deviations are specified in terms of a displacement above or below the isoelectric level. To calculate this displacement, the monitor compares the amplitudes of the signal at two user-selectable measurement points in the patient's QRS waveform. One point is typically set at the isoelectric level on the waveform. The other point is typically set within the ST segment of the waveform. The difference (in millimeters or millivolts) between the amplitude of the isoelectric point and the amplitude of the ST measurement point represents the ST deviation. The available settings for each point are:

- Isoelectric Point: from the start of the averaged ST complex to the Fiducial point, in increments of 4 ms

- ST Measurement Point: from the Fiducial point to the end of the averaged ST complex, in increments of 4 ms

The default position for the isoelectric point is -28 milliseconds before the start of the QRS complex, as measured along the horizontal (time) axis. The default position for the ST measurement point is +80 milliseconds after the end of the QRS complex. The starting and ending points for the QRS complex are determined by the QRS detection algorithm.

In practice, however, the determination of the isoelectric and ST measurement points must be made on the basis of a careful clinical evaluation. The ST display provides the means for changing the isoelectric and ST measurement points in order to ensure an accurate ST deviation measurement.

> **NOTE:** You should always check the position of the isoelectric and ST measurement points before starting ST monitoring.

STEPS: Setting the Isoelectric and ST Measuring Points

1. Click on the **ST** parameter box.

2. Click on **ISO**. Two vertical lines, indicating the location of the ISO and the ST measurement points, appear in the ST waveform channels.

`ISO: -92 ms  ST: 236 ms  Ref:  ON  Save:`

3. With the rotary knob, move the position of the ISO point to the desired location and click the knob. The corresponding value (in milliseconds) is shown next to the ISO label.

4. Click on **ST**.

5. With the rotary knob, move the position of the ST measuring point to the desired location and click the knob. As you dial, the ST deviation values to the right of the ST waveforms change according to the new measuring point location.

ST Reference Complex

The averaged ST segment waveform(s) displayed in the ST menu can be saved as reference complexes. The reference waveforms can then be superimposed on the current ST segment waveform to highlight changes in the ST segment since the last save. Upon saving, the reference complex is time-stamped and available for display.

STOP

WARNING: If you change an ECG lead and access the ST Setup menu, you lose the saved ST reference complex. The saved ST reference complex is retained if you change a lead and later reselect it without entering the ST Setup menu.

STEPS: Displaying the ST Reference Complex

1. Click on the **ST** parameter box.

2. Click on **Ref** to turn the display of the reference complex ON or OFF.

ISO: –92 ms ST: 236 ms Ref: ON Save:

STEPS: Saving the ST Reference Complex

1. Click on the **ST** parameter box.

2. Click on **Save**. Date and time of saving appear next to the Save option.

ISO: –116 ms ST: 152 ms Ref: ON Save: 08Jun01 15:02

ST Alarms

Set ST alarm limits on the Alarm Limits table (see the chapter *Alarms and Messages*). The default ST segment deviation alarm limits are +1.0 mm (or +0.10 mV) for the upper limit and -1.0 mm (or -0.10 mV) for the lower limit. However, adjustments to the upper and lower alarm limit settings must be made based on careful clinical evaluation. You can set the upper and lower limits within the following range:

■ -15.0 mm to +15.0 mm, in 0.1 mm increments (-1.5 mV to +1.5 mV, in 0.01 mV increments, when using millivolts.)

NOTE: Always check the upper and lower ST alarm limits before starting ST monitoring.

11 Respiration Monitoring

Overview

➤ **NOTE:** The Rsp parameter box is not displayed when you first enable the ST, IBP2, or the etCO$_2$ or Multigas locked options. Rsp monitoring can be restored, however, when you select Show Rsp in the Main Screen menu (see below).

The monitor measures impedance respiration by passing a harmless high-frequency current between two ECG electrodes on the patient's chest. Electrical resistance (impedance) between the electrodes varies with the chest's expansion and contraction during inspiration and expiration. The monitor can derive a respiration waveform and rate from these impedance changes.

You can set the monitor's breath detection sensitivity to Auto or Manual. If set to Auto, the monitor automatically adjusts the breath detection sensitivity according to the average size of the detected breaths. If set to Manual, the detection sensitivity is based on the waveform amplitude you select (see the section *Respiration Monitoring Display*, below).

The monitor is designed to:

- Display the respiration waveform continuously.
- Calculate the average respiration rate per minute.
- Detect apnea in adult, pediatric, and neonatal patients.

➤ **NOTE:** When using a 3-Lead ECG cable, you must display ECG lead II. If Lead I or III is displayed instead, the monitor does not calculate a respiration rate and requests that you select Lead II.

Patient Preparation

Selecting and Preparing the Electrodes

Proper selection and preparation of the ECG electrodes is important for effective respiration monitoring. See the chapter *ECG and Heart Rate* for information on preparing and placing electrodes.

Preparing the Patient's Skin

Follow the recommended instructions given in the chapter *ECG and Heart Rate*.

Electrode Placement for Respiration Monitoring

For respiration monitoring, the signal is passed by the same electrodes used for cardiac monitoring, as illustrated below. The monitor uses the right arm (RA) electrode and the left leg (LL) electrode as the path for the high-frequency signal.

For deep abdominal breathers, you may want to move the right arm (RA) electrode, in order to span the maximum expansion and contraction of the lungs.
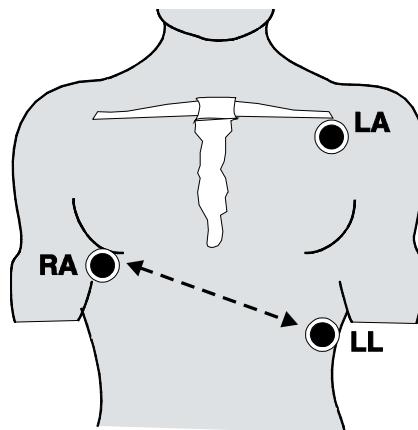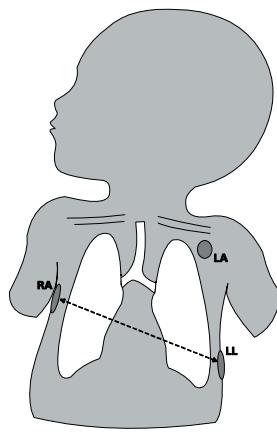
➤ **NOTE:** If you are using this electrode placement for monitoring respiration, lead I and II will be compromised for monitoring ECG.

Respiration Monitoring Display

You can display the respiration waveform in one of the bottom display channels.

➤ **NOTES:**

- The monitor has a total of three or, as an option, four waveform display channels. For more information, contact your Dräger representative.

- When using a 3-Lead ECG cable, you must display ECG lead II. If Lead I or III is displayed instead, the monitor does not calculate a respiration rate and requests that you select Lead II.

- The respiration waveform moves at 25% (~ 6.25mm/sec) of the rate of other waveforms on the screen.

The respiration rate appears in the **Rsp** parameter box next to the Rsp waveform. When you start monitoring, the rate value does not appear until the detection of six valid breaths.

Displaying Respiration Data

If the ST, IBP2, and either the etCO$_2$ or Multigas locked options are enabled, you can call up the Rsp display from the Main Screen menu as follows:

STEPS: Displaying Respiration Data

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Main Screen**.

4. Click on **Show Rsp/etCO2**.
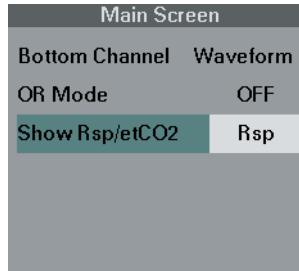
5. Select **Rsp** and click the knob.

> **NOTE:** The menu option **Show Rsp/etCO2** appears only if the ST, IBP2, and either the etCO2 or Multigas locked options are enabled.

When you first turn the respiration display on, the monitor relearns the patient's respiration pattern and displays *Rsp Relearning* in the message field at the bottom of the screen and the **LRN** label in the Rsp parameter box.

Rsp Display Channel

Display the Rsp Waveform in one of the bottom display channels as follows:

STEPS: Selecting the Rsp Display Channel

1. Click on the desired waveform channel.
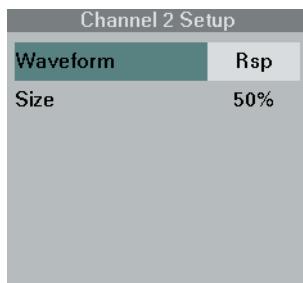
2. Click on **Waveform**.

3. Select **Rsp** and click the knob.

Resp Display Amplitude

The **Size** option lets you increase or decrease the amplitude of the respiration waveform. In manual breath detection sensitivity mode (see the section *Selecting the Rsp Mode*, below), the detection sensitivity is based on the selected waveform amplitude. Available amplitude settings are:

■ 10% to 100%, in increments of 10% (default 50%)

WARNING: In Manual Mode, if you set the size of the respiration waveform too low, shallow breaths may not be counted. If set too high, cardiac artifact might be counted as breaths. Therefore, always turn respiration markers on in manual mode to help you select an appropriate waveform amplitude/detection sensitivity (see the section *Displaying Rsp Markers*).

STEPS: Selecting the Rsp Display Amplitude

1. Click on the **Rsp waveform** channel.

2. Click on **Size**.

Channel 2 Setup	
Waveform	Rsp
Size	50%

3. Select the desired display amplitude and click the knob.

Respiration Monitoring Settings

Rsp Mode

To enable respiration monitoring, select the Auto or Manual Respiration Monitoring Mode.

In Auto mode, the monitor adjusts the breath detection sensitivity to the strength of the respiration signal, adjusting it over several minutes. It also adjusts the sensitivity for large baseline drifts and lead-off conditions.

In Manual mode, you adjust the sensitivity by increasing or decreasing the waveform display amplitude (see the section *Selecting the Rsp Display Amplitude*).

STEPS: Selecting the Respiration Mode

1. Click on the **Rsp** parameter box.

2. Click on **Resp. Mode**.
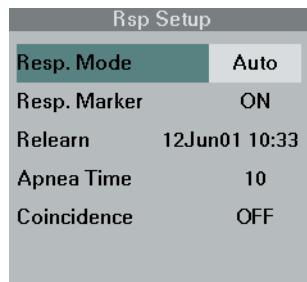
3. Select the desired monitoring mode (**Auto** or **Manual**) or turn respiration monitoring off (**OFF**).

Resp Markers

When you turn respiration markers on, the monitor displays a spike on the respiration waveform every time it detects a valid breath. (Respiration markers are not printed.) If breath detection occurs on a clipped portion of the waveform (as when the waveform exceeds the waveform channel's selected size), respiration is still detected and marked.

In manual mode, always use the displayed markers to set the waveform size at a point where shallow breaths are counted and cardiac artifacts rejected.

STEPS: Displaying Resp Markers

1. Click on the **Rsp** parameter box.

2. Click on **Rsp. Marker**.

Rsp Setup	
Resp. Mode	Auto
Resp. Marker	ON
Relearn	12Jun01 10:33
Apnea Time	10
Coincidence	OFF

3. Select **ON** or **OFF** and click the knob.

Apnea Time

The monitor detects apnea in all monitoring modes provided an apnea time is selected in the menu. Apnea times are:

- 10 to 30 seconds, in increments of 5.

Upon detection of an apnea event and after the selected apnea time has elapsed, the monitor triggers a serious alarm.

➤ **NOTE:** Regardless of the apnea time setting, the monitor continues to alarm for respiration rate, artifact, and lead-off conditions if the respiration alarm is On.

STEPS: Selecting the Apnea Time

1. Click on the **Rsp** parameter box.

Rsp Setup	
Resp. Mode	Auto
Resp. Marker	ON
Relearn	13Jun01 13:42
Apnea Time	10
Coincidence	OFF

2. Click on **Apnea Time**.
3. Select the desired setting and click the knob.

➤ **NOTE:** The value selected for Apnea Time will also update the RRc Apnea option in the $etCO_2$ parameter menu.

Coincidence Alarm

The coincidence alarm alerts you when the respiration rate is within 20% of the heart rate over three consecutive breaths. This alarm indicates that the monitor may be counting heart beat artifacts as respiration signals. The monitor alarms and displays the message *Coincidence* **if the coincidence alarm is turned on**. If the coincidence alarm is off, the monitor does not alarm but still displays the message. This alarm grade is serious for neonatal monitoring and advisory for adult and pediatric monitoring. Check and change the electrode placement if you receive a coincidence message until you obtain a clear respiration signal.

STEPS: Turning the Coincidence Alarm On/Off

1. Click on the **Rsp** parameter box.

Rsp Setup	
Resp. Mode	Auto
Resp. Marker	ON
Relearn	13Jun01 13:42
Apnea Time	10
Coincidence	ON
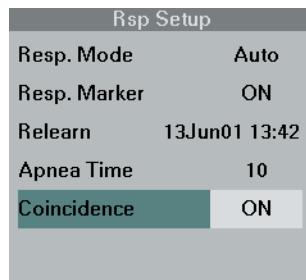
2. Click on **Coincidence**.
3. Select the desired setting (**On/OFF**) and click the knob.

Relearning a Patient's Respiration Pattern

When respiration monitoring is enabled and set to **Auto**, the monitor takes about one minute to automatically learn the patient's respiration pattern. You can initiate a new learning phase at any time. When respiration monitoring is enabled and set to **Manual**, you must initiate the learning of the respiration pattern manually. Whenever you change or reposition electrodes or if you notice significant changes in the patient's breathing pattern, repeat the learning process.

STEPS: Relearning a Patient's Respiration Pattern

1. Click on the **Rsp** parameter box.
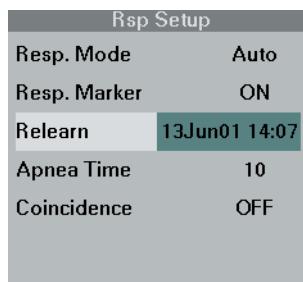
2. Click on **Relearn**.

During the learning phase, the monitor displays the message *Rsp Relearning* at the bottom of the screen and the **LRN** label in the Rsp parameter box. During the learning phase, the patient should rest as quietly as possible and breathe normally.

Rsp Safety Considerations

WARNINGS:

■ **Do not rely upon impedance respiration monitoring as the sole method for detecting the cessation of breathing. Patients at risk for respiratory distress should be observed closely and heart rate alarms should be enabled and set appropriately. The use of additional methods for respiratory monitoring, such as etCO$_2$ and SpO$_2$ are recommended whenever possible.**

■ **Large amplitude pacer spikes (100 mV or greater) may interfere with the monitor's ability to monitor respiration.**

■ **Impedance respiration monitoring and pacemaker spike detection are inoperative when using either the shielded blue leads or the ESU block.**

OxyCRG Monitoring (Neonatal Option)

The monitor offers a neonatal Oxycardiorespirogram (OCRG or OxyCRG) provided the option is enabled on your monitor (for more information, see your Dräger representative). Neonatal OxyCRG is a non-invasive procedure to display a beat-to-beat heart rate (bbHR) trend, an SpO_2 trend, and a respiration waveform simultaneously on a dynamically updated display. (OCRG monitoring requires that sensors and electrodes for SpO_2, HR, and respiration are attached to the patient.)

Displaying OCRG Waveforms

The OxyCRG waveforms are displayed in the second and third waveform channels.

The second waveform channel shows the beat-to-beat Heart Rate (bbHR) trend and the SpO_2 trend waveforms. The bbHR trend has a range of 65 to 290 and is displayed in green. The SpO_2 trend has a range from 75% to 100% and is displayed in white. The third waveform channel shows a time-compressed respiration waveform (Rsp in blue) or, if $etCO_2$ is enabled and displayed, a time-compressed $etCO_2$ waveform (RRc in yellow).

You can adjust the size of the OCRG waveform via the **Size** selection in the third waveform channel menu (see below).
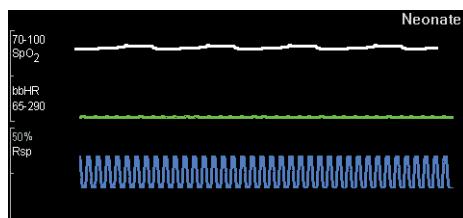
STEPS: Displaying the OCRG Waveforms

1. Click on the **second** or **third waveform** channel.

2. Click on **Waveform**.

Channel 3 Setup	
Waveform	OCRG
Size	90%
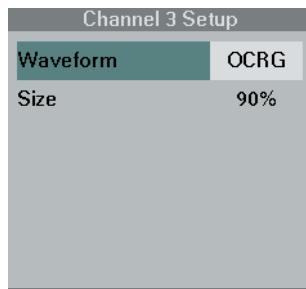
3. Select **OCRG** and click the knob.

STEPS: Adjusting the OCRG Waveform Size

1. Click on the **third waveform** channel.

2. Click on **Size**.

Channel 3 Setup	
Waveform	OCRG
Size	50%

3. Select the desired size and click the knob.

OCRG Recordings

The monitor can print OCRG alarm and manual recordings, if OCRG waveforms are displayed. OCRG recordings show the second and the third waveform channels (not the first channel).

An apnea event triggers an OCRG alarm recording, which includes 108 seconds of pre-apnea OCRG data and 36 seconds of post-apnea OCRG data.

If no recorder is available, the monitor stores the OCRG apnea alarm recording (see the chapter Recordings for a description of stored recordings).

➤ **NOTE:** OCRG recordings cannot be printed on a laser printer.

```
>>                         BED200   04-Jan-00
>>   OCRG              150                                    100
>>                   1/min                                      %
>>   BED200           bbHR                                   SpO₂
>>   CU1
>>   REC177           100                                     75
>>
>>   04-Jan-00        Rsp
>>   05:10
>>
>>                   -72s.      -54s.      -36s.     -18s.      0s.
>>
                           47 11 201 E527U
```
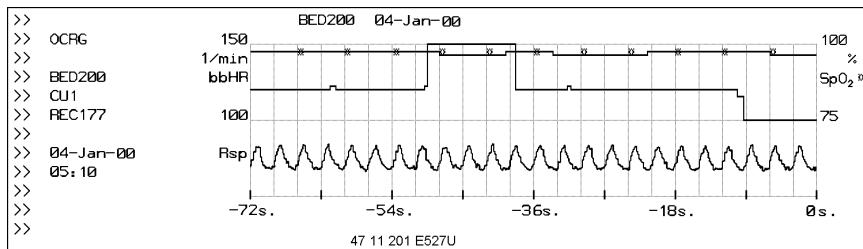
12 Pulse Oximetry

Overview

Pulse Oximetry monitoring is a non-invasive procedure to determine the functional oxygen saturation of the patient's arterial blood (SpO_2) and an accompanying pulse rate.

A sensor is attached to the patient (usually the finger) and measures the absorption of light by the oxyhemoglobin. The light sent through the tissue is transformed into a signal that is processed by the monitor. The monitor is designed to:

- Display the oximetry waveform.
- Calculate the SpO_2 pulse rate.
- Identify critical levels of arterial oxygen saturation.

Sensor Application

The quality of SpO_2 measurements depends largely on the strength and quality of the signal received by the sensor.

Infinity Gamma Series monitors support Nellcor and Masimo SpO_2 sensors. The SpO_2 menu shows which sensor type is currently selected. If you connect a sensor different from the type shown in the SpO_2 menu, the monitor displays an error message.

Selecting the sensor type is a password-protected function.To change the sensor type, contact your Biomed department.

STEPS: Applying the Sensor

1. Select a sensor that is best suited for your patient (type and size, see the list of available sensors in the appendix *Options and Accessories*).

2. Clean reusable sensors before and after each use.

3. Position the sensor correctly and attach it to your patient (see sensor manufacturer's recommendations).

4. Connect the sensor to the intermediate cable and the intermediate cable to the MULTIMED/NEOMED pod.

5. Inspect the sensor application site frequently. If the sensor is too tight, it may damage the tissue and impede blood flow. If the sensor is damaged, do not use it.

⚠ *CAUTION: Read the instructions provided with the sensor to select the best application technique and to review all safety related information.*

SpO$_2$ Safety Considerations

STOP

WARNINGS:

- During electrosurgery, use only Dräger SpO$_2$ shielded extension cables with a blue locking mechanism to protect from ESU interference.

- Check sensors periodically (recommended is at least every four hours). Move the sensor if there is any sign of skin irritation or impaired circulation.

- Bright light can interfere with pulse oximetry measurements, causing erratic or missing values. When the sensor is likely to become exposed to direct bright light, it should be covered with an opaque material.

- Elevated levels of carboxyhemoglobin or methemoglobin in monitored patients can result in inaccurate pulse oximetry readings.

- If the monitor detects an SpO$_2$ and/or PLS *Weak Signal* condition during an NBP measurement, the audible and visual alarms for the *Weak Signal* condition are suppressed. However, the monitor announces all other SpO$_2$/PLS conditions as they occur.

- Difficulties inherent in SpO$_2$ monitoring require that patients receive special attention during electrosurgery (ESU). To minimize interference from the ESU, do the following:

  -- Place the SpO$_2$ sensor as far from the surgical site as possible.

  -- Place the SpO$_2$ cables as far from the ESU as possible, and perpendicular to the ESU cables.

  -- Use an ESU neutral electrode with the largest possible contact area.

  -- When possible, place the ESU neutral electrode close to and directly under the surgical site avoiding bony protuberances. If this is not possible, interference from the ESU may result.

  -- Consult the operating instructions of your electrosurgical equipment for additional information.

SpO$_2$ Monitoring Display

The quality of the pulse waveform and the SpO$_2$ values are an indication that the sensor is attached to the patient correctly. In most clinical situations, the waveform is displayed in the second or third channel in order to view the electrocardiogram in the first channel during SpO$_2$ monitoring. The message *SpO$_2$ Searching* appears following the connection of the sensor to the patient.

Within seconds, the first pulse oximetry value appears in the SpO$_2$ parameter box. When the SpO$_2$ and PLS alarms are turned off, a crossed bell appears next to the parameter values.

SpO$_2$ Display Channel

When monitoring with a 5- or 6-lead ECG cable, you can display the SpO$_2$ waveform in any waveform channel. If monitoring with a 3-lead ECG cable, you cannot display the SpO$_2$ waveform in the top channel.

STEPS: Selecting the SpO$_2$ Display Channel

1. Click on the desired waveform channel.

2. Click on **Waveform**.
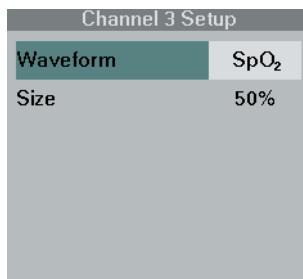
3. Select **SpO2** and click the knob.

SpO$_2$ Display Amplitude

The **Size** option lets you modify the amplitude of the displayed SpO$_2$ waveform for optimum viewing. The available sizes are

- 10% to 100%, in increments of 10% (default 50%).

STEPS: Selecting the SpO$_2$ Display Amplitude

1. Click on the **SpO$_2$ waveform** channel.
2. Click on **Size**.

Channel 3 Setup	
Waveform	SpO$_2$
Size	50%
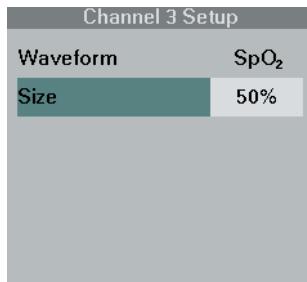
3. Dial in the desired setting and click the knob.

Cascade Display

The pulse waveform is about four seconds long. To display eight seconds of the same waveform, select the Cascade display mode.

➤   **NOTES:**

■ The second channel of a cascaded pulse waveform cannot be printed on recordings.

■ The Cascade display is only available in the second waveform channel. Cascade is not available on monitors with the ST, $etCO_2$ and the second invasive blood pressure options enabled.

STEPS: Selecting the Cascade Display

1. Assign SpO_2 to the **first** display channel.

2. Select the **second** waveform channel and click the knob.

3. Click on **Waveform**.

Channel 2 Setup	
Waveform	Cascade

4. Select **Cascade** and click the knob.

➤   **NOTE:** The cascade SpO_2 waveform disappears from the screen whenever you choose to display the electrocardiogram again in the first channel. If you then want to display the standard SpO_2 waveform, select the second or third channel.

SpO$_2$ Monitoring Settings

Pulse Tone Source

You can select either ECG or SpO$_2$ as the source for the pulse tone. When SpO$_2$ is the pulse tone source, the pitch of the tone is modulated according to O$_2$ blood saturation levels. A tone occurs with each pulse detected via the SpO$_2$ signal. You can add a bar graph to the SpO$_2$ parameter box to show signal strength (see later in this chapter).

Select SpO$_2$ as the pulse tone source when pulse oximetry is the primary vital sign to monitor or preferred over ECG (e.g., with paced patients or in the presence of HR artifacts).

STEPS: Selecting the Pulse Tone Source

1. Click on the **SpO2** parameter box.

2. Click on **Tone Source**.

SpO$_2$ Setup	
Tone Source	SpO$_2$
Tone Volume	OFF
Bar Graph	OFF
Averaging	Normal
SensorType	Nellcor

3. Select **SpO2** and click the knob.

Pulse Tone Volume

When SpO_2 is selected as the tone source, the pulse tone changes with the level of arterial oxygen saturation. Low saturation levels result in low pitched tones; high saturation levels result in high pitched tones. If SpO_2 is selected as the tone source but is not currently being measured, no pulse tones are heard. You can adjust the pulse tone volume or turn the pulse tone off. The available settings are:

■ High, Medium, Low and OFF.

STEPS: Selecting the Pulse Tone Volume

1. Click on the **SpO2** parameter box.

2. Click on **Tone Volume**.

SpO_2 Setup	
Tone Source	SpO_2
Tone Volume	Medium
Bar Graph	OFF
Averaging	Normal
Sensor Type	Nellcor
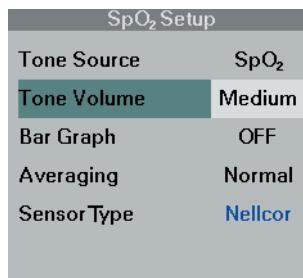
3. Select the desired setting and click the knob.

➤ **NOTE:** If you select a Tone Volume higher than the speaker volume of the monitor, the Tone Volume is that of the speaker volume. If you select a lower setting, the pulse tone sounds at the selected volume.

Signal Strength Bar Graph
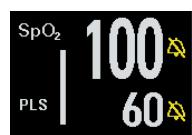
The monitor can display a pulsing bar graph. The number of illuminated segments is proportional to the pulse amplitude. Proper sensor placement and environmental conditions ensure a strong signal. Refer to the section *Sensor Application* for details.

STEPS: Displaying the Signal Strength Bar Graph

1. Click on the **SpO2** parameter box.

2. Click on **Bar Graph**.
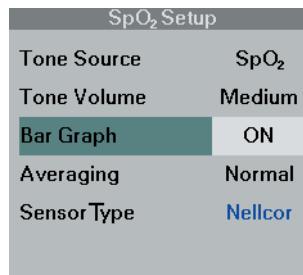
3. Select **ON** or **OFF** and click the knob.

Averaging Mode

The monitor calculates the oxygen saturation of the arterial blood and the derived pulse rate based on the averaging mode you select in the SpO_2 menu. The two modes are Normal and Fast.

■ The Normal averaging mode updates the SpO_2 value and the derived pulse rate in 30 seconds or less.

■ The Fast averaging mode updates the SpO_2 value and the derived pulse rate in 12 seconds or less.

Response time may improve as pulse rate increases.

➤ **NOTE:** When monitoring most patients, Dräger recommends using the Normal averaging mode. The Fast mode is designed for neonatal patients where fast reporting of oxygen desaturation is of concern.

STEPS: Selecting the Averaging Mode

1. Click on the **SpO2** parameter box.

2. Click on **Averaging**.

SpO_2 Setup	
Tone Source	SpO_2
Tone Volume	OFF
Bar Graph	ON
Averaging	Normal
Sensor Type	Nellcor
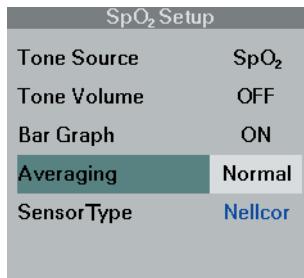
3. Select the desired setting (Normal or Fast) and click the knob.

13 End-Tidal CO2

Overview

The Infinity Gamma Series monitor measures concentrations of end-tidal CO_2 ($etCO_2$) when this option is enabled and the $etCO_2$ pod or a Scio multigas module is connected to your monitor. (Ordering information about these options is available from your Dräger representative.) The $etCO_2$ pod can perform mainstream measurements in all monitoring modes and sidestream measurements in the adult and pediatric monitoring modes. The Scio multigas module can perform sidestream measurements in the adult and pediatric monitoring modes.

➤ **NOTE:** This chapter describes $etCO_2$ monitoring with the $etCO_2$ pod. For information about monitoring with the Scio multigas module, see the chapter *Multigas*.

The $etCO_2$ pod acquires signals from a CAPNOSTAT® sensor. For mainstream measurements, the Capnostat fits over an adapter inserted into the patient's airway. For sidestream measurements, the Capnostat fits on the nasal sampling cannula tubing.

The Capnostat analyzes the patient's expired and inspired air by sending a beam of infrared light through transparent ports in the adapter and detecting changes in the CO_2 absorption levels. The $etCO_2$ pod processes this data and derives values for the following parameters:

- **Instantaneous CO_2** — The instantaneous value of the CO_2 level. Displayed on the monitor as a waveform (or capnogram) depicting the variation in airway CO_2 levels during a patient's respiration cycle.

- **End-tidal CO_2 ($etCO_2$)** — The level of CO_2 in the airway at the end of expiration. If you specify one breath as the averaging interval, the monitor reports the CO_2 level at the end-expiration point of each breath. If you specify a particular averaging interval (10 or 20 seconds), the monitor reports the maximum value measured during this interval. The current value for $etCO_2$ is displayed in the $etCO_2$ parameter box.

- **Inspired CO_2 (iCO_2)** — The level of CO_2 in the airway during inspiration. Taken as the minimum value during the previous measurement interval. The current value for iCO_2 is displayed in the $etCO_2$ parameter box.

- **Respiration Rate (RRc)** — The patient's respiration rate; derived from the $etCO_2$ signal by calculating an average rate over the eight most recent breaths. The current value of RRc is displayed in the $etCO_2$ parameter box.

$etCO_2$ Source

The monitor can receive CO_2 signals from a connected $etCO_2$ pod or Scio multigas module.

STEPS: Selecting the $etCO_2$ Signal Source

1. Click on the $etCO_2$ parameter box.

2. Click on **$etCO_2$ Source**.

3. Select **POD** or **SCIO** and click the knob.

➤ **NOTES:**

- The monitor displays the $etCO_2$ parameter box, when $etCO_2$ (rather than Respiration) has been selected for display in the Main Screen menu. For information about the Main Screen configuration and the menu selection Show Rsp/$etCO_2$, see the chapter *Monitor Setup*.

- The menu selection *$etCO_2$ Source* only appears when $etCO_2$ *and/or* Scio multigas monitoring is enabled.

- If the monitor receives CO_2 signals from the Scio module, you can set the RRc Apnea time in the $etCO_2$ menu, but no other $etCO_2$ setup functions are available in the menu.

etCO$_2$ Display

The etCO$_2$ parameter box displays the current values for etCO$_2$, iCO$_2$ and RRc. A lung icon appears next to the RRc parameter label and blinks every time a breath is detected. If the Scio module is the signal source, the parameter labels are marked with an asterisk (*). If alarms are set to Off, a crossed-bell icon appears next to each parameter label.

➤ **NOTE:** The etCO$_2$ waveform moves at 25% (~ 6.25mm/sec) of the rate of other waveforms on the screen.

The illustration below depicts a normal etCO$_2$ waveform:
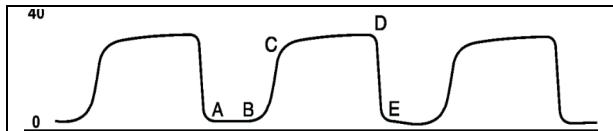
The letters A - E indicate the phases of the respiration cycle:

A-B Baseline (the level of minimum CO$_2$ concentration) observed immediately after inspiration.

B-C Expiration phase.

C-D Expiratory plateau. The level of CO$_2$ in the lungs ceases to increase significantly.

D End-tidal concentration point at the end of the expiration phase, at which etCO$_2$ is measured.

D-E Onset of the inspiration phase.

Display Channel and Waveform Amplitude

You can display the $etCO_2$ waveform in one of the lower waveform channels. The **Size** option lets you modify the display amplitude of the $etCO_2$ waveform for optimum viewing. The available sizes are:

■ 40, 60, 80, 100 mmHg (5, 8, 10, 12, kPa or %)

STEPS: Selecting the $etCO_2$ Display Channel and Waveform Amplitude

1. Click on the desired waveform channel.

2. Click on **Waveform**.

Channel 2 Setup	
Waveform	etCO$_2$
Size	40
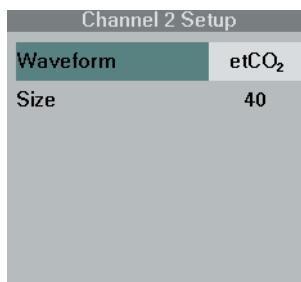
3. Select **etCO$_2$** and click the knob.

4. Click on **Size**.

5. Select the desired setting and click the knob.

➤ **NOTE:** In the OR mode (see the chapter *Multigas*), the $etCO_2$ waveform is always displayed in the bottom waveform channel to the left of the CO_2 parameter box. In OR mode, you cannot change this location nor select a different Main Screen screen layout.

Monitoring Preparations

Connecting Sensor and etCO$_2$ Pod

1. Connect the Capnostat sensor to the etCO2 pod as shown.

2. Connect the etCO2 pod to the monitor as shown.

> ➤ **NOTE:** For mainstream measurements, the Capnostat snaps over an adapter inserted into the patient's airway. For sidestream measurements, the Capnostat snaps on the nasal sampling cannula tubing (see below).

etCO$_2$ Connections

Capnostat

Monitor

Nafion Tubing
(sidestream)

Attaching the Capnostat and Airway Adapter

The configuration of the airway adapter and Capnostat sensor vary, depending on whether you are setting up mainstream or sidestream monitoring. The following pictures show each configuration. Refer to your Capnostat instructions for further information.

Mainstream Monitoring

In mainstream monitoring mode, the patient is intubated with an endotracheal tube that is connected to a ventilator (see below).
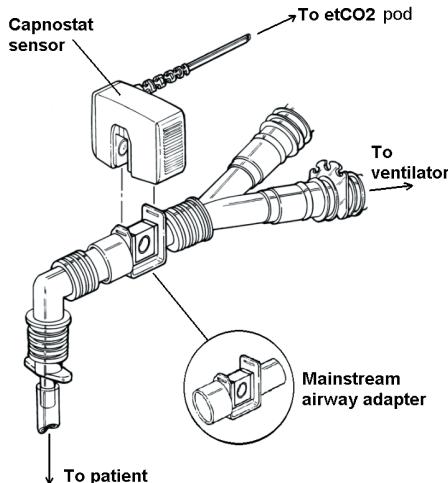
STEPS: Mainstream Monitoring Setup

1. Select a mainstream airway adapter. Make sure the windows are clean and dry. Clean or replace the adapter if necessary.

2. Snap the airway adapter into the Capnostat. Align the mark on the bottom of the adapter with the mark on the bottom of the sensor. You will hear a click when the connection is made.

3. If you are switching adapter types (e.g., mainstream to side-stream, or adult to neonatal, etc.), you must perform an adapter calibration. Refer to the section *Calibrating the adapter and sensor* section in this chapter.

4. Insert the airway adapter in a vertical position between the elbow and the ventilator circuit "Y". Make sure that the sensor cable is positioned away from the patient.

➤ **NOTE:** It is important to position the adapter vertically. This prevents patient secretions from obscuring the adapter windows.

Sidestream Monitoring (Adult and Pediatric Modes Only)

Sidestream monitoring is appropriate for non-intubated patients or for intubated patients who are breathing spontaneously. A pump in the etCO$_2$ pod draws air through the Capnostat, which samples the patient's inspired and expired air as it passes a nasal sampling cannula. The figure below illustrates a sidestream monitoring setup.

➤ **NOTE:** Sidestream monitoring is disabled in neonatal monitoring mode.
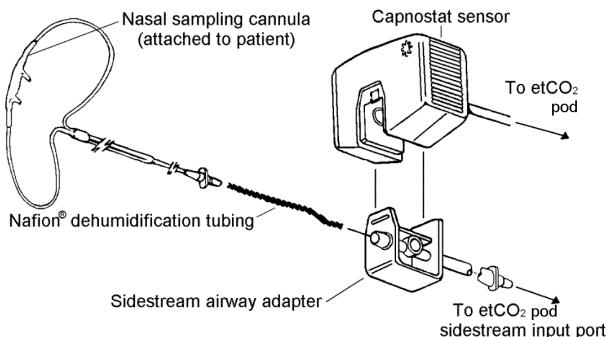
STEPS: Sidestream Monitoring Setup

1. Select a sidestream airway adapter. Make sure the windows are clean and dry. Clean or replace the adapter if necessary.

2. Use the sidestream sampling tubing to connect the airway adapter to the bacteria filter. The filter can be locked in place with the luer lock connection to the tubing. This connects to the input connector on the face of the etCO$_2$ pod.

3. Dräger recommends you connect a NAFION$^®$ dehumidification tubing set.

4. Connect a nasal sampling cannula to the dehumidification tubing set, if one is used; otherwise, connect the cannula directly to the sidestream airway adapter.

➤ **NOTE:** Dehumidification and cannula tubing can affect the calibration of the airway adapter. If you change to different combinations or lengths of cannula and dehumidification tubing, perform an adapter calibration.

5. Snap the sensor into the airway adapter. Align the mark on the bottom of the adapter with the mark on the bottom of the sensor.

6. If you are switching adapter types (e.g., mainstream to sidestream, or adult to neonatal), you must perform an adapter calibration. Refer to the section *Calibrating the Adapter and Sensor* in this chapter.

7. Insert the cannula tips into the patient's nostrils, pass the cannula tubing behind the ears, and slide the retaining sleeve up so that the tubing is snug under the chin.

8. Secure the Capnostat sensor to the bedding or to the patient's bed clothing.

9. Make sure the sensor cabling and nasal cannula tubing are secured and out of the patient's way.

➤ **NOTE:** It is important to always position the airway adapter vertically. This prevents patient secretions from obscuring the adapter windows.

Calibrating the Sensor and Adapter

Before etCO$_2$ monitoring, you need to calibrate the Capnostat sensor and airway adapter so that the etCO$_2$ pod can compensate for the specific characteristics of sensor and adapter.

Sensor Calibration

In most cases, you need to calibrate the Capnostat sensor only when you connect it to a particular etCO$_2$ pod for the first time. After this initial calibration, the pod stores the characteristics of the current sensor in its memory. Even when you later disconnect the sensor and then reconnected it to the same etCO$_2$ pod, the pod can recall and use the calibration results.

Perform a calibration whenever you connect a different sensor to the pod. Date and time of the last sensor calibration are displayed in the etCO$_2$ menu's Sensor Cal. field.

STEPS: Calibrating the Sensor

1. Make sure the monitor is turned on and that the etCO$_2$ pod is properly connected.

2. Allow the sensor to warm up (~2 minutes at room temperature). When the sensor reaches a stable temperature, the monitor displays the message *etCO$_2$ Place Sensor on Zero Cell*.

3. Locate the combined Zero/Reference cell.

4. Place the sensor onto the Zero cell. The calibration process begins automatically, and takes about 20 seconds. During calibration, the monitor displays the message *etCO$_2$ Calibrating Sensor*. When calibration is complete, the monitor displays the message *etCO$_2$ Place Sensor on Ref Cell*.

5. Place the sensor on the Reference cell. During verification, the monitor displays the message *etCO$_2$ Verifying Sensor Cal*. When the verification process is complete, the monitor displays the message *etCO$_2$ Sensor Cal. Verified*.

6. Remove the sensor from the Reference cell. When the monitor displays the message *etCO$_2$ Check Airway Adapter/Cal.*, you can connect the Capnostat sensor to the patient's airway adapter.

You can now use the sensor. If the verification fails, the monitor again displays the message *etCO$_2$ Place Sensor on Zero Cell*.

Adapter Calibration

Perform an adapter calibration every time you switch adapter types (e.g., mainstream to sidestream or adult to neonatal). You do not normally have to calibrate an adapter if you are replacing it with another of the same type.

STEPS: Calibrating the Airway Adapter

1. Click on the **etCO$_2$** parameter box.

2. Hold the sensor and the adapter away from any source of CO$_2$ (including the patient's mouth or your own).

3. Click on **Adapter Cal.**
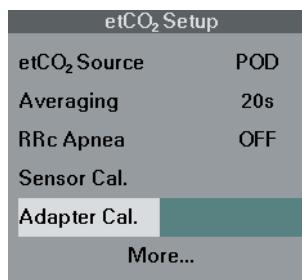
The calibration takes approximately 15 seconds. The monitor displays the message *etCO$_2$ Calibrating Adapter*. When calibration is successfully completed, the monitor displays the message *etCO$_2$ Adapter Cal. Accepted*. A status message appears if calibration fails.

etCO$_2$ Monitoring Settings

Averaging Mode

The monitor displays the highest etCO$_2$ measurement calculated during a specified interval. **Averaging** enables you to set this interval to Instantaneous, Breath, 10 seconds, or 20 seconds. The default is 10 seconds. Choose **Breath** (i.e., one etCO$_2$ measurement for each breath) for patients whose breathing patterns are consistently regular. Choose **20 s** for patients with erratic breathing patterns. Choose **Instant.** for immediate display of values (no value averaging).

> ➤ **NOTE:** The instantaneous averaging mode is primarily used by biomedical or service personnel for calibration purposes.

STEPS: Setting the Averaging Interval

1. Click on the **etCO$_2$** parameter box.

2. Click on **More...**

3. Click on **Averaging**.

etCO$_2$ Setup	
etCO$_2$ Source	POD
Averaging	20s
RRc Apnea	OFF
Sensor Cal.	
Adapter Cal.	
More...	
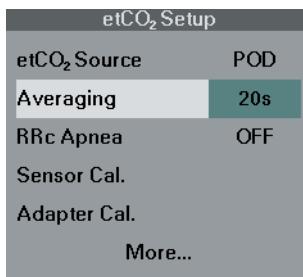
4. Select the desired averaging mode and click the knob.

RRc Apnea Time

The monitor can detect apnea in all monitoring modes based on changes in exhaled CO_2 values. Apnea times are:

■ 10 to 30 seconds in increments of 5 or OFF

➤ **NOTE:** In neonatal monitoring mode, the Apnea alarm is on by default.

Upon detection of an apnea event and after the selected apnea time has elapsed, the monitor triggers a serious alarm.

STEPS: Setting the RRc Apnea Time

1. Click on the **etCO₂** parameter box.

2. Click on **More...**

3. Click on **RRc Apnea**.

etCO₂ Setup	
etCO₂ Source	POD
Averaging	20s
RRc Apnea	10
Sensor Cal.	
Adapter Cal.	
More...	
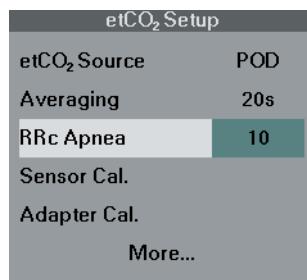
4. Select the desired apnea time and click the knob.

➤ **NOTE:** Changing the value for the RRc Apnea time also changes the Apnea Time setting for Rsp monitoring.

Balance

The monitor assumes a default oxygen concentration of 21% (the percentage of oxygen in ambient air) for all $etCO_2$ measurements. If the patient is receiving supplemental oxygen or an anesthetic agent, you must select the gas being administered (available settings are N_2O/O_2, >60% O_2, and Heliox). Failure to compensate for supplemental gases results in inaccurate $etCO_2$ measurement values. Depending on the selection, gas composition values are as follows:

Selection	Expired Composition Values (%)				
	CO_2	O_2	N_2	N_2O	He
Air	5	17	78	0	0
N_2O/O_2	5	35	0	60	0
>60% O_2	5	75	20	0	0
Heliox	5	35	0	0	60

STEPS: Setting a Balance for Airway Gases

1. Click on the **etCO$_2$** parameter box.

2. Click on **More...**

3. Click on **Balance**.

4. Select a desired gas balance (**Air**, **N$_2$O/O$_2$**, **>60% O$_2$** or **Heliox**) and click the knob.

Measuring Mode

Configure the etCO$_2$ pod for mainstream or sidestream monitoring as follows.

STEPS: Selecting the Measuring Mode

1. Click on the **etCO$_2$** parameter box.

2. Click on **More...**

3. Click on **Meas. Mode**.

etCO$_2$ Setup	
Balance	Air
Meas. Mode	Main
Insp. Agent	0
Exp. Agent	0
Atm. Press. Mode	Auto
Atm. Pressure	760
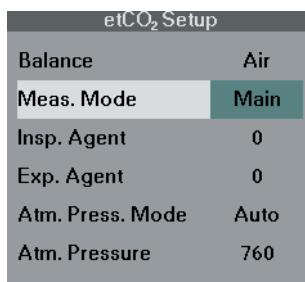
4. Select the desired measurement mode (**Main** or **Side**) and click the knob.

Anesthetic Agent Compensation

The monitor allows the user to adjust the etCO$_2$ detection to compensate for expired and inspired anesthetic agents in the patient's air supply. Failure to compensate for anesthetic agents results in inaccurate measurement values. Available compensation settings are:

■ 0% to 20%, in increments of 1% (default 0%).

> **NOTE:** If you set the Expired field, the Inspired field automatically adjusts to an appropriate value. However, if you set the Inspired field, the Expired field does not change.

STEPS: Setting Anesthetic Agent Compensation

1. Click on the **etCO₂** parameter box.

2. Click on **Exp. Agent** (or **Insp. Agent**).

3. Select the desired compensation and click the knob.

Atmospheric Pressure Compensation

The monitor can automatically detect the ambient barometric pressure and compensate for it during $etCO_2$ measurements. Alternatively, you can enter atmospheric pressure values manually. Current barometric pressure values appear next to the **Atm. Pressure** selection in the $etCO_2$ parameter box.

➤ **NOTES:**

- The type of atmospheric pressure compensation is usually selected by your hospital's service personnel. Consult your Biomed before changing the pressure compensation mode.

- In automatic pressure mode, you cannot change the atmospheric pressure value manually.

STEPS: Selecting the Atmospheric Pressure Mode

1. Click on the **etCO$_2$** parameter box.

2. Click on **More...**

3. Click on **Atm. Press. Mode**.

4. Select the automatic or manual mode and click the knob.

STEPS: Entering Atmospheric Pressure Values Manually

1. Click on the **etCO$_2$** parameter box.

2. Click on **More...**

3. Click on **Atm. Pressure**.

etCO$_2$ Setup	
Balance	Air
Meas. Mode	Main
Insp. Agent	2
Exp. Agent	2
Atm. Press. Mode	Manual
Atm. Pressure	760

4. Dial in the current barometric pressure value.

➤ **NOTE:** Atmospheric pressure values can be read from a barometer or obtained by calling the closest weather station.

etCO2 Alarms

The monitor alarms for the following $etCO_2$ parameters:

- $etCO_2$ alarm (critical levels of CO_2 saturation in the exhaled breath).

- iCO_2 alarm (critical levels of CO_2 saturation in the inhaled breath, or rebreathing).

- RRc alarm (significant changes in the respiratory rate, derived from the capnogram waveform).

- RRc Apnea alarm (apnea conditions based on the respiratory rate derived from the capnogram waveform).

In addition, the monitor alarms for unplugged cables, weak signals, and in the absence of periodic measurement updates.

You can set $etCO_2$ upper and lower limits for all monitoring modes within the following range:

- 5 to 95 mmHg for the $etCO_2$ alarm (0.7 to 12.7 kPa or %).

- 4 to 10 mmHg for the iCO_2 alarm (0.5 to 1.3 kPa or %).

- 5 to 145 breaths per minute for the RRc alarm (mainstream).

- 5 to 65 breaths per minute for the RRc alarm (sidestream).

Turn $etCO_2$ alarms on or off and set the alarm limits in the Alarm Limits table (see the chapter *Alarms and Messages*).

14 Multigas

Overview

➤ **NOTES:**

  ■ Multigas monitoring is only available for the monitor Gamma XL (not for the monitor Gamma). Multigas monitoring is a locked option and restricted to those clinical sites that have the corresponding gas monitoring capabilities and delivery systems in place.

  ■ Multigas monitoring is only available in the Adult and Pediatric monitoring modes.

  ■ During Multigas monitoring, the monitor does not display the ST parameter box and ST monitoring is disabled.

The Gamma XL supports multigas monitoring functions when operating in the OR mode. The monitor receives multigas data from a Dräger Scio multigas module and can display concentrations of O_2, CO_2, N_2O, and of the anesthetic agents halothane, isoflurane, enflurane, sevoflurane, and desflurane.

Connections

Gamma XL with Scio

Standalone Monitor

Connect the intermediate cable's 15-pin serial connector to connector **X2** on the back of the Scio module. Connect the cable's other end to connector **X5** on the monitor's rear-panel interface plate.

➤ **NOTE:** When the Scio module is connected to the monitor's interface plate, data collection via the export protocol is not available.

X2 (15 pin)

X5

Scio Module (back panel)   **Gamma XL Interface Plate**
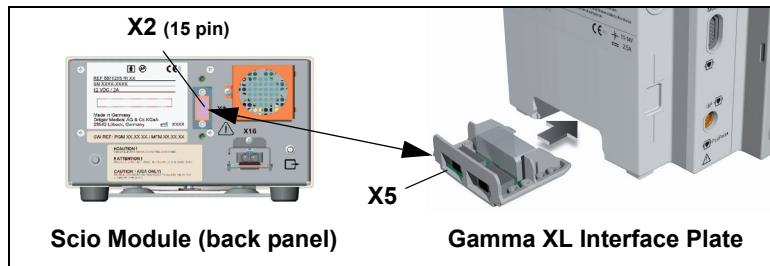
Networked Monitor

Connect the intermediate cable's 15-pin serial connector to connector **X2** on the back of the Scio module. Connect the cable's other end to connector **X5** on the Infinity Docking Station (IDS).

X2 (15 pin)

X5

Scio Module (back panel)   **IDS (back panel)**
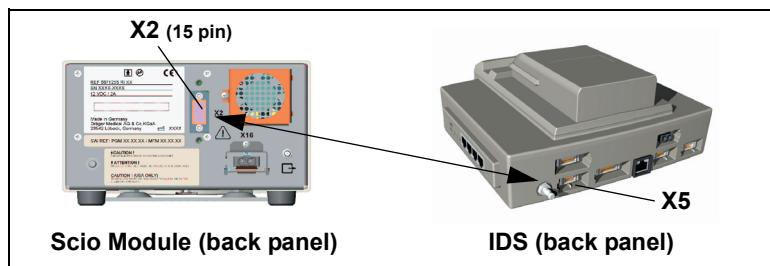
The Scio Module

The Scio module is a free-standing unit that samples breathing gases from adult and pediatric patients in non-, partial- and total rebreathing systems at a sample flow rate of 150 ±20 ml/min. The module measures inspiratory and expiratory gases and communicates both real-time and derived gas information to the monitor.

STOP

WARNING: Sampling of the respiratory gas from the patient breathing circuit reduces the delivered patient tidal volume. Clinicians should adjust the fresh gas supply as necessary.

For the measurement of CO_2 and volatile anesthetics, the Scio module draws a small amount of the patient's respiratory gas through a measuring chamber. It then shines an infrared light through the chamber which the sample gas components absorb in different amounts, depending on the gas concentrations. For the measurement of O_2 the Scio module uses a paramagnetic cell that produces a physical reaction proportional to the O_2 concentration.

CAUTIONS:

- *The displayed gas information is intended to be used by trained and authorized health care professionals only.*

- *The Scio module purges and zeroes itself approximately once every 2 hours. The purging/zeroing cycle lasts no longer than 25 seconds. During this time, the monitor does not update the displayed Scio parameter values on the screen and blanks the $etCO_2$ waveform. The message* Multigas Zero in Progress *appears in the message area.*

- *Due to the response time of the sensors and the gas sample flow rate, the stated accuracy of O_2, CO_2, N_2O and anesthetic agents is limited by the respiratory rate and by the inspiratory to expiratory ratio (I:E). For details, see the* Technical Data *appendix.*

Scio Module: Front and Rear Panels

Water Trap

External Power Indicator

Fan Filter

Exhaust Port

Connector for
External Power Supply
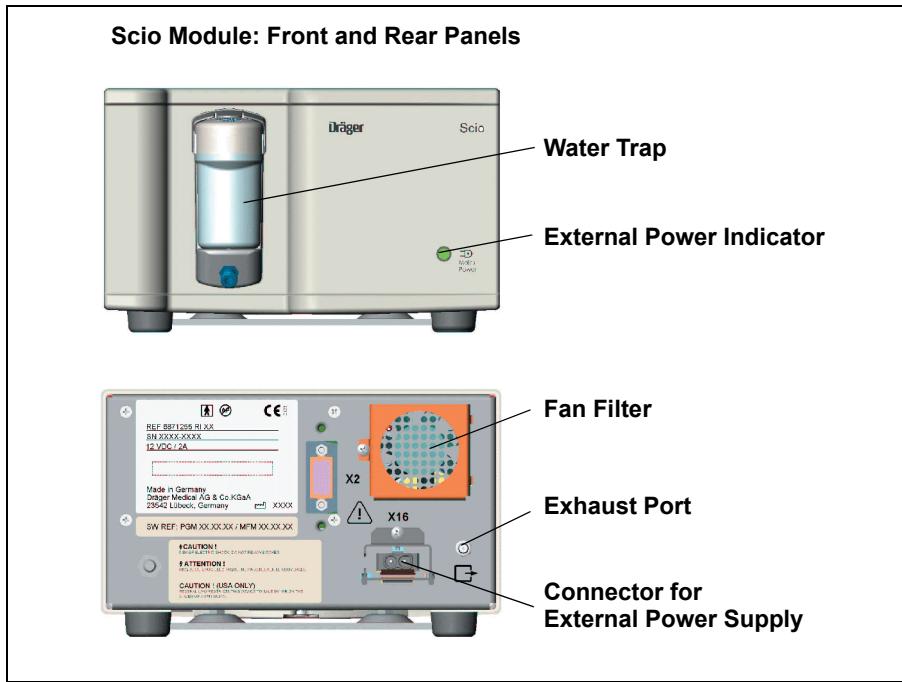
NOTES:

- The presence of organic cleaning solutions or gases containing freon may adversely impact the accuracy of the Scio module.

- Mechanical shocks during the measurement or the presence of other paramagnetic agents can distort measured values of oxygen concentration.

- The Scio module is self-zeroing and does not need routine calibration by the clinical staff. However, a yearly check of the Scio calibration components should be performed by authorized technical personnel.

- To ensure safety, the Scio module requires routine cleaning. For instructions see the appendix *Cleaning, Disinfecting, Sterilizing*.

Warm-Up

Upon start-up, the Scio module passes through an initialization and warm-up period. During this time, concentrations for certain gases may not be available and the anesthetic agent may not be identified. Scio achieves full accuracy after a warm-up period of about 5 minutes.

STOP

WARNING: During warm-up, reported values may not be accurate. Refer to the *Technical Data* appendix for a detailed description of Scio accuracy.

Site of Operation

The site of operation must meet the temperature, humidity, and atmospheric pressure requirements listed in the appendix *Technical Data*. In addition, observe the following guidelines:

■ Make sure that the platform which supports the module is large enough, level, and stable.

■ Make sure that the fan exhaust screen at the rear of the module and the ventilation holes on the underside are not obstructed.

■ Place the module at least 25 cm (10 inches) away from any possible source of ignition, such as sparking.

■ Place the module close enough to the patient so that the sampling lines can reach the airway T-connector and the exhaust tubing the hospital's exhaust gas scavenging system without stretching.

STOP

WARNINGS:

■ **Do not use mobile phones within 33 feet (10 m) of the Scio module. Such phones may cause equipment malfunction.**

■ **Do not expose the Scio module to mechanical vibrations or shock during measurements. Mechanical vibrations or shock can have adverse effects on measured gas values.**

■ **The operation of the Scio module in magnetic resonance imaging environments (MRI) is not supported.**

■ **Do not use a Scio module near devices with microwave or other high-frequency emissions. These emissions may interfere with the module's operation.**

- **The Gamma XL and the Scio module must both be connected to a hospital outlet (USA: hospital-grade outlet) within the same medically used room.**

- **When the Gamma XL is used with the Scio module, it meets the Class A limits of CISPR11. The system is not intended for connection to public mains.**

Installing/Removing the Water Trap

Push the water trap into its receptacle on Scio's front panel until the trap clicks into place. Make sure the trap is empty.

To remove the trap, hold it firmly on the ridged surfaces and pull it out of the receptacle.
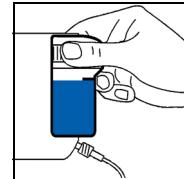
(For information on emptying the water trap and related maintenance functions, see the appendix *Cleaning, Disinfecting, Sterilizing*.)

Connecting Sampling Lines and Power Cord

1. Connect one end of the sampling line to the water trap, and the other end to the airway T-connector.

2. Connect one end of the exhaust tubing to the exhaust port at the rear of the module, and the other end to the hospital's gas-scavenging system.

3. Connect the power supply to the power connector at the rear of the module.

4. Connect the power supply to an outlet specified for the use of medical equipment in a hospital.

NOTES:

- Sampling lines and T-connectors to the patient's airway are not reusable. They must be replaced under the following conditions:
  -- A new patient is connected to the module.
  -- The cleanliness of the tubing/connector is suspect.

- Use only Dräger-approved sidestream sampling lines. Dräger does not assume responsibility for the reliability and safety of Scio measurements, if non-approved tubing is used.

WARNINGS:

- **Do not use the module without a Watertrap.**

- **Sampling lines should be kept as short as possible (but not stretched) to minimize dead space and optimize response time. Long sampling lines degrade the performance of side stream measurements, may affect accuracy, and result in slower response times.**

- **Always use Dräger-approved Scio sampling lines (polypropylene).** *Never* **use standard pressure-sensor tubing (PVC). PVC tubing absorbs anesthetic agents, which it later releases (degassing). The use of standard PVC tubing can result in erroneous agent concentration readings.**

- **Sampling lines and T-connectors are not reusable and must be replaced after each patient. Water traps and fan filters must be replaced at regular intervals (see the appendix *Cleaning, Disinfecting, Sterilizing*).**

- **To avoid the risk of explosion, do not use flammable anesthetic agents such as ether and cyclopropane in the presence of the Scio module.**

OR Mode

➤ **NOTE:** Multigas monitoring is available only for monitors Gamma XL in the OR mode. The OR mode is available only for the adult and pediatric patient categories.

STEPS: Selecting the OR Mode

1. Verify that the adult or pediatric patient category is selected.

2. Press the **Menu** fixed key.

3. Click on **Monitor Setup**.

4. Click on **Main Screen**.

Main Screen	
Bottom Channel	All
OR Mode	ON
Show Rsp/etCO2	etCO$_2$
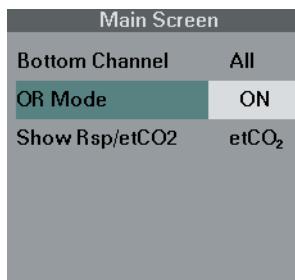
5. Click on **OR Mode**.

6. Select **ON** and click the knob.

The main screen configuration changes to the OR layout, showing the CO_2 and multigas parameter boxes as well as the etCO$_2$ waveform in the bottom channel (see below).

➤ **NOTE:** The alarm behavior for some parameters changes in the OR mode. For details, see the chapter *Alarms and Messages*.
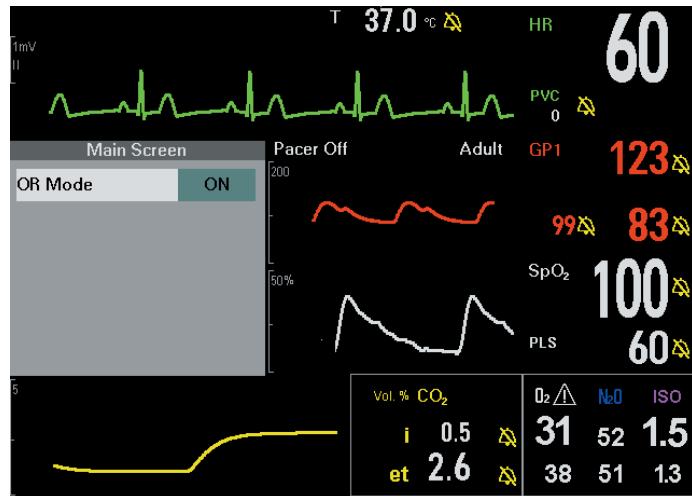
> **NOTES:** The following display/monitoring restrictions apply in the OR mode:

- The ST parameter box is not available and deviations in the ST segment are neither monitored nor saved in the trend storage.

- The NBP parameter box is only available when two ECG waveforms occupy the top two waveform channels. In this case, the NBP parameter box is displayed next to the second ECG waveform. If the NBP parameter box is not displayed, you cannot take NBP measurements.

- In OR mode, the $etCO_2$ waveform is always displayed in the bottom waveform channel to the left of the CO_2 parameter box. You cannot change this location nor select a different bottom channel display. In OR mode, the menu selection Bottom Channel therefore does not appear in the Main Screen or Fast Access menus.

CO2 Display and Setup
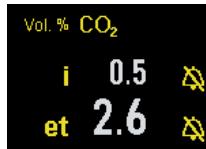
The CO_2 parameter box displays the inspired and expired values for CO_2 in Vol%. If CO_2 alarms are disabled, crossed-bell icons appear next to the corresponding parameter values.

In OR mode, the $etCO_2$ waveform is always displayed in the bottom waveform channel. You cannot change its display location in the OR mode.

In OR mode, Scio is automatically the $etCO_2$ source, regardless of previous source selections. (The source selection item on the $etCO_2$ Setup menu is for display only in the OR mode.)

> **NOTE:** When you exit the OR mode, the Scio module remains the $etCO_2$ source and the parameter labels $etCO_2$, iCO_2 and RRc are displayed with an asterisk (*). In order to change the $etCO_2$ source, click on the $etCO_2$ parameter box and change the source selection (SCIO or POD) in the $etCO_2$ setup menu.

Available CO$_2$ Setup Functions in OR Mode

Adjust the $etCO_2$ waveform amplitude by clicking on the waveform and selecting a **Size** between 5 and 12 (Volume %).

Set the RRc apnea time between 10 and 30 seconds (or OFF) by clicking on the CO_2 parameter box and on **RRc Apnea**.

For more information on $etCO_2$ setup functions, see the chapter *End-Tidal CO2*.

Multigas Display and Setup
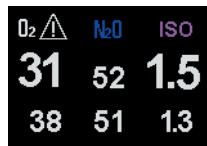
The multigas parameter box displays the inspired and expired values in Vol% for O_2, N_2O, and for one of the anesthetic agents halothane (HAL), isoflurane (ISO), enflurane (ENF), sevoflurane (SEV), or desflurane (DES), if present. The multigas parameter box does not show alarm limits, but shows an alert icon ⚠ next to the O_2 label when the lower alarm limit for iO_2 is set below 21%.

If the Scio module reports concentration values for two anesthetic agents to the monitor, the monitor displays the concentration values of the primary agent in the parameter box and indicates the name of the secondary agent briefly in the message area, accompanied by an attention tone.

If the Scio module reports the presence of more than two agents in the breathing system, the monitor indicates a gas mixture (Mix) and displays (***) for the agent values in the parameter box.

➤ **NOTES:**

- The primary agent is the agent with the higher MAC value (minimum alveolar concentration). 1 MAC is equal to the alveolar anesthetic concentration at one atmosphere (760 mmHg) at which 50% of all patients no longer respond to noxious stimuli.

- If the Scio module has a software version older than 1.19.00, it does not report concentration values for more than one agent at a time. In this case, the monitor indicates a gas mixture and displays (***) in the agent parameter box, if more than one agent is present in the breathing system.

- With the exception of inspired and end-tidal CO_2, Scio parameters do not appear on remote views called up on monitors within the network.

Agent Override

The Multigas Setup menu allows you to select a specific agent for display, thereby overriding the automatic agent detection. However, if Scio cannot detect the specified agent, the monitor blanks the agent values in the parameter box. If Scio detects a different agent, the monitor also displays a status message indicating the detected agent.

➤ **NOTE:** When an agent has been specified in the Agent Override menu, the monitor does not alarm for any other agent nor does it store any other agent's values in the trend storage.

STEPS: Selecting Agent Override

1. In OR mode, click on the O2/N2O/Agent parameter box.

2. Click on **Agent Override**.

3. Select the desired agent or OFF and click the knob.

Multigas Alarms

Set upper and lower multigas alarm limits on the Alarm Limits table. Access the table with the **Alarm Limits** fixed key and scroll to the multigas parameters, or call up the table as follows:

1. Click on the O2/N2O/Agent parameter box.

2. Click on **Multigas Alarms**.

➤ **NOTE:** The chapter *Alarms and Messages* lists multigas alarm and status messages as well as suggested remedies.

Autozero Delay

The Scio module is self-zeroing. It automatically initiates zeroing of its gas sensors against room air about every 2 hours. During zeroing, the monitor does not update the displayed Scio parameter values on the screen. If zeroing cannot be completed within 25 seconds, the monitor blanks the Scio parameter values and displays an error message (see the chapter *Alarms and Messages*).

One minute before the start of zeroing, the monitor sounds an attention tone (2 beeps) and displays the message *Multigas zero in 1 minute*. You can delay zeroing once for a 5-minute period as follows:

STEPS: Requesting an Autozero Delay

1. In OR mode, click on the O2/N2O/Agent parameter box.

2. Click on **Autozero Delay**.

WARNING: Delaying zeroing may compromise the accuracy of gas values.

NOTE: The menu selection Autozero Delay is only displayed and available for one minute, just before zeroing starts.

15 Non-Invasive Blood Pressure

Overview

STOP **WARNINGS: Before non-invasive blood pressure monitoring, please read the safety information in the section** *NBP Safety Considerations***, below.**

STOP **WARNINGS: Before monitoring neonates and infants:**

- **Select the correct cuff size for your patient.**

- **Select the neonatal or pediatric patient category in the Patient Admit menu. This protects neonates, infants, and pediatric patients from high cuff pressures used for adults.**

- **Select the proper Inflation Mode (Neo 90, Neo 140, Pediatric 180).**

➤ **NOTES:**

- Dräger recommends NBP calibration checks as part of regular monitor maintenance and whenever the accuracy of measurement values is in doubt. NBP calibration checks should be performed by qualified technical personnel. See the appendix *Default Settings and Biomedical Support* for a description of the NBP calibration check. For detailed calibration instructions, refer to the Service manual.

- In the OR mode (see the chapter *Multigas*), the NBP parameter box only appears on the screen when two ECG waveforms occupy the top two waveform channels. In this case, the NBP parameter box is displayed next to the second ECG waveform. If the NBP parameter box is not displayed, you cannot take NBP measurements. To display the NBP parameter box in OR mode, see the section *NBP Measurements in OR Mode*, below.

The monitor can acquire and process non-invasive blood pressure (NBP) signals and display the results. Blood pressure measurements are determined by the oscillometric method and are equivalent to those obtained by intra-arterial methods, within the limits prescribed by the Association for Advancement of Medical Instrumentation, Electronic Automated Sphygmomanometers (AAMI/ANSI SP-10).

If the pulse signal is poor due to patient movements, improper cuff placement or noise in the signal, the cuff deflates and the monitor attempts a second measurement. For causes and possible remedies for a poor pulse signal see the alarm message tables in the chapter *Alarms and Messages*.

The monitor displays the systolic, diastolic, and mean pressure values in the NBP parameter box (mmHg or kPa). You can select an enlarged NBP display in the bottom channel of the main screen display. For more information, see the section *Main Screen Configuration* in the Monitor Setup chapter.

At the end of each NBP measurement, the NBP cuff deflates to a pressure of 10 mmHg or less (adult and pediatric modes), or to a pressure of 5 mmHg (neonatal mode).

Cuff Selection and Placement

The quality of NBP monitoring depends largely on the quality of the signals received by the monitor. For this reason, it is important to select the correct cuff size for your patient. Cuff sizes are clearly marked on the cuff. Measure the circumference of your patient's limb. Use only Dräger-approved cuffs with your monitor (see the appendix *Options and Accessories*).

STEPS: Applying the NBP Cuff

1. Ask the patient to sit or lie down. The limb should be relaxed, extended and placed on a smooth surface for support.

2. Place the cuff at 2 to 5 cm above the elbow crease (or in the middle of the back of the thigh).

3. Place the "Artery ↓" marker over the artery, pointing to hand or foot.

4. Wrap the deflated cuff snugly around the limb without impeding blood flow.

5. Caution the patient not to talk or move upon inflation of the cuff.

To avoid kinks in the hose, center the cuff bladder on the artery so that the hose is to the left or to the right of the artery.

Connect the NBP cuff and hose to the monitor's hose connector on the left side of the device.

NBP Connector

NBP Safety Considerations

WARNINGS:

■ **Changes in the cuff position relative to the heart level affect measurements. If the cuff is not placed at heart level, add +1.4 mmHg for each 2 cm above the heart and subtract -1.4 mmHg for each 2 cm below the heart. Make sure that the hose is not kinked or obstructed. Do not place the cuff on a limb with an infusion line.**

■ **In some cases, rapid and prolonged measurements can result in petechia, ischemia, purpura or neuropathy. Dräger recommends that you apply the cuff appropriately and that you check the cuff site regularly when monitoring at frequent intervals or over extended periods of time. In addition, check the patient for signs of impeded blood flow in the limb.**

■ **NBP measurements may not be accurate with convulsive patients or patients with tremors.**

CAUTION: Do not allow the hose or cuff to get in contact with fluids. Check the hose and cuff frequently for signs of damage and debris. An obstruction in the hose may cause the cuff to inflate and deflate improperly and may result in inaccurate readings.

NOTE: To obtain accurate blood pressure readings, keep the limb and cuff motionless. To protect patients from extremely high cuff pressures and extended cuff inflation, the cuff deflates automatically in the following conditions:

■ The cuff pressure exceeds 273 mmHg in Adult 270 inflation mode, or 180 mmHg in Pediatric 180 inflation mode.

■ The cuff pressure exceeds 150 mmHg in either Neo 140 or Neo 90 inflation modes.

■ The measurement takes longer than 2 minutes for Adult 270 or Pediatric 180 inflation modes.

■ The measurement takes longer than 90 seconds (or longer than 60 seconds in French NFC mode) for Neo 140 or Neo 90 inflation modes.

■ A technical alarm has occurred.

NBP Measurements

Single Measurements

The monitor gives you two options for taking NBP measurements:

■ Taking single NBP measurements.

■ Selecting the Interval Mode to take NBP measurements automatically at specific time intervals.

➤ **NOTE:** After an NBP measurement, the valves are opened to ensure that all residual pressure is released from the cuff. During this process, it is normal for the NBP valves to "chatter" for a few moments following the NBP measurement.

STEPS: Taking a Single NBP Measurement

1. Press the fixed key **NBP Start/Stop**. The cuff inflates.

2. Wait until the cuff deflates.

At the end of the measurement, the monitor emits an end-of-measurement tone (2 beeps), if the measurement tone is enabled in the NBP menu (see below). To cancel an NBP measurement in progress, press **NBP Start/Stop** again.

Interval Mode

The interval mode lets you program the monitor to initiate NBP measurements automatically at specific intervals. The following time intervals are available:

■ 2, 2.5, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 30, 45, 60, 120, 180, 240 minutes (or OFF).

➤ **NOTE:** The minimum time between the end of an automatic interval measurement and the next automatic measurement is 30 seconds.

STEPS: Taking NBP Interval Measurements

1. Press and hold the **NBP Start/Stop** key,

    or

1. Click on the **NBP** parameter box.

2. Click on **Interval Mode**.
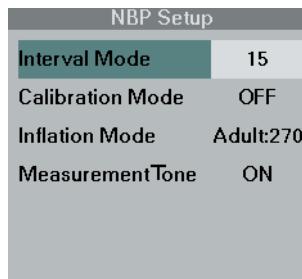
3. Select the desired interval and click the knob.

➤ **NOTES:**

- When you press and hold the NBP Start/Stop key to turn the Interval Mode on, the interval time is the one that was previously selected.

- If the Interval Mode is active before you power cycle the monitor, the Interval Mode setting is retained through a power cycle. If the Interval Mode is turned off before you power cycle the monitor, you have to reselect an interval time in the NBP menu, before interval measurements can be started with the NBP Start/Stop key.

- During an active single NBP measurement, you cannot turn the Interval Mode on or off.

To end interval measurements, press and hold the **NBP Start/Stop** key or turn the Interval Mode **OFF** in the NBP menu.

As soon as you turn the interval mode on, the monitor starts an NBP measurement. A bar graph appears in the NBP parameter box to indicate the time left until the start of the next measurement.

In addition to measurements in the automatic cycle, you can take a single measurement at any time. However, if the bar graph empties before the end of your single NBP measurement, the next automatic NBP measurement occurs only when the bar graph empties again. As a result, the monitor skips one interval measurement.

If the monitor detects an error (while the NBP alarm is on), any attempts to take NBP measurements (single or at intervals) generate an error tone. For more information, see the chapter *Alarms and Messages*.

Inflation Mode

You must select the appropriate inflation limits for your patient. The following table shows the monitor's inflation values for each inflation mode:

Inflation Mode	Initial Inflation (mmHg)	Inflation After a Valid Measurement (mmHg)	Maximum Inflation (mmHg)	Minimum Inflation (mmHg)
Neo 90	80 ± 5	Last NBP sys + 20	80 ± 5	70 ± 5
Neo 140	110 ± 5	Last NBP sys + 30	142 ± 5	70 ± 5
Pediatric 140	110 ± 5	Last NBP sys + 30	142 ± 5	70 ± 5
Pediatric 180	130 ± 5	Last NBP sys + 25	180 ± 5	90 ± 5
Adult 180	130 ± 5	Last NBP sys + 25	180 ± 5	90 ± 5
Adult 270 (default)	180 ± 5	Last NBP sys + 25	265 ± 5	110 ± 5
In neonatal monitoring mode, you can only select Neo 90 and Neo 140 (Neo 90 is the default). In pediatric monitoring mode, you can only select Neo 90, Neo 140, Pediatric 140 and Pediatric 180 (Pediatric 180 is the default).				

STEPS: Selecting the Inflation Mode

1. Click on the **NBP** parameter box.

2. Click on **Inflation Mode**.


```
            NBP Setup
Interval Mode        OFF
Calibration Mode     OFF
Inflation Mode       Neo.:140
Measurement Tone     ON
```
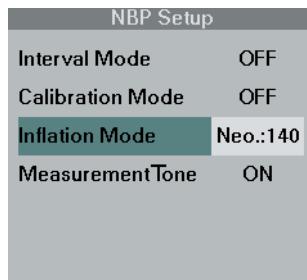
3. Select the desired inflation mode and click the knob.

WARNING: In neonatal monitoring mode, a blood pressure higher than the inflation range may activate the "*NBP Cannot Measure*", "*NBP No Pulsation*", or "*NBP Mean Only*" alarms. If this happens, manually check the patient's pressure and, if appropriate, select the Neo 140 inflation mode or switch to a Pediatric inflation mode.

Measurement Tone

The end of an NBP measurement can be indicated by an end-of-measurement tone (2 beeps). The loudness of the tone depends on the setting for the monitor's speaker volume. If the volume is turned off, the tone does not sound.

STEPS: Turning the Measurement Tone ON/OFF

1. Click on the **NBP** parameter box.

2. Click on **Measurement Tone**.

NBP Setup	
Interval Mode	OFF
Calibration Mode	OFF
Inflation Mode	Adult:270
Measurement Tone	ON
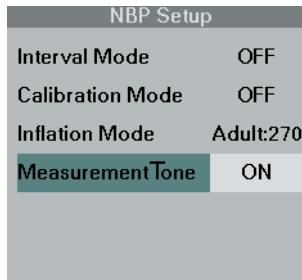
3. Select **ON** or **OFF** and click the knob.

NBP Measurements in OR Mode

In the OR mode (see the chapter *Multigas*), the NBP parameter box only appears on the screen when two ECG waveforms occupy the top two waveform channels. If the NBP parameter box is not displayed, you cannot take NBP measurements.

STEPS: Displaying NBP in the OR mode

1. Make sure that 5- or 6-lead ECG monitoring is selected in the HR Setup menu (see the chapter *ECG and Heart Rate*).

    ➤ **NOTE:** You cannot display two ECG waveforms when 3-lead ECG monitoring is selected.

2. Make sure the first waveform channel shows an ECG waveform (or click on the channel and select an ECG lead for display).

3. Click on the second waveform channel and select a second ECG lead for display. This brings up the NBP parameter box to the right of the second ECG.

4. To save this screen configuration, save the setup (a password-protected function, see the appendix *Default Settings and Biomedical Support*.)

NPB Alarms

Turn NBP alarms on or off and set alarm limits on the Alarm Limits table (see the chapter *Alarms and Messages*). If alarms are on, the monitor alarms for limit violations as well as patient movements, improper placement of the cuff and overpressure conditions.

➤ **NOTE:** When an NBP alarm occurs, the monitor alerts you **once** and, when the alarm is acknowledged by pressing the Alarm Silence or the All Alarms Off key, will not alert you again of the same alarm even though displayed values may remain out of limits.

You can set the systolic, mean, and diastolic alarm limits within the following range:

■ 1 to 250 mmHg, in increments of 1 mmHg.

16 Invasive Blood Pressure

Overview

During invasive blood pressure monitoring (IBP), the monitor measures arterial and venous blood pressures and

- Displays one or two pressure waveforms continuously (the monitoring of two invasive pressure parameters is available as an option).

- Calculates systolic, mean, and diastolic invasive blood pressures values.

In the IPB setup menu (see the section *Invasive Pressure Labels*), you can select one of the following pressure labels to identify the type of invasive blood pressure being monitored.

ART	Arterial Pressure
PA	Pulmonary Arterial Pressure
CVP	Central Venous Pressure
ICP	Intracranial Pressure
GP1/GP2	Generic Pressure Label 1 and 2 (GP2 is available as an option)

➤ **NOTE:** This manual refers to the invasive blood pressure parameter generally as IBP1 or IBP2. The actual displayed pressure labels are those you choose in the IBP setup menu. Always select an appropriate label for your invasive pressure monitoring session.

Set IPB alarms on the Alarm Limits table (see the chapter *Alarms and Messages*). If you are monitoring two invasive pressure parameters, each has its own alarm settings. For invasive pressure parameters that generate only a mean pressure value, you cannot set systolic or diastolic alarm limits.

Invasive Pressure Labels

STEPS: Selecting the Invasive Pressure Label

1. Click on the IBP1 parameter box.

2. Click on **Label**.
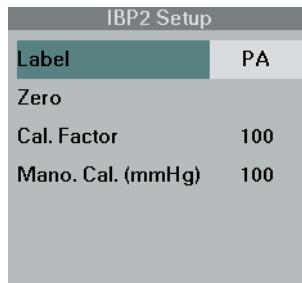
3. Select the appropriate pressure label for your monitoring session and click the knob.

IBP Display

The monitor measures pressure in millimeters of mercury (mmHg) or kilo pascals (kPa), and can display up to two pressure waveforms in the lower display channels. The pressure parameter boxes show the following information:

- Parameter label (e.g., ART).

- Systolic pressure value (e.g., 125).

- Diastolic pressure value (e.g., 85).

- Mean pressure value (e.g., 102).

- A crossed bell if invasive pressure alarms are turned off.
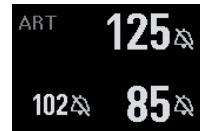
If the second invasive pressure option is enabled, the second invasive blood pressure has its own parameter box.

Display Channel and Waveform Amplitude

The monitor displays pressure waveforms in the lower display channels. Depending on the pressure label, you can select waveform amplitudes within the following ranges:

Pressure Label	Possible Size Settings	Adult/Pediatric Default Setting	Neonatal Default Setting
ART, GP1, GP2	50, 75, 100,...300 mmHg (8, 12, 16,...40 kPa)	200 mmHg (24 kPa)	100 mmHg (16 kPa)
PA	20, 40, 50, 75, 100, 150 mmHg (4, 6, 8, 12, 16, 20 kPa)	50 mmHg (8 kPa)	50 mmHg (8 kPa)
CVP	-5, 10, 20, 30, 40, 50 mmHg (-1.0, 2, 4, 5, 6, 8 kPa)	20 mmHg (4 kPa)	20 mmHg (4 kPa)
ICP	0, 5, 10, 15, 20, 50, 100 mmHg (1, 2, 3, 4, 8, 16 kPa)	20 mmHg (4 kPa)	10 mmHg (2 kPa)

STEPS: Selecting the IBP Display Channel and Waveform Amplitude

1. Click on the desired waveform channel.

2. Click on **Waveform**.
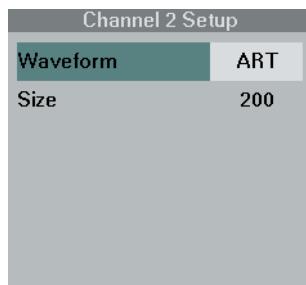
3. Select the desired pressure parameter and click the knob.

4. Click on **Size**.

5. Select the desired display amplitude and click the knob.

➤ **NOTE:** The Channel setup menu makes only those pressure labels available which have been selected for the monitoring session in the IBP setup menu (or the default GP1/GP2).

Selecting and Preparing the Transducer

STOP

WARNINGS:

- ■ **Never re-use a single-use (disposable) transducer.**

- ■ **Dräger approved transducers provide protection for the patient against burns during electrosurgery or defibrillation. Use of non-approved transducers may compromise this protection.**

The quality of pressure monitoring depends on the quality of the signals received by the monitor. To maximize the strength of the pressure signal when it reaches the transducer, assemble the tubing system carefully following the application techniques of your hospital. Noise and motion artifact as well as air bubbles in the tubing system distort the signal and give inaccurate measurements. Consider the following:

1. Select a high pressure tubing system (compliant tubing dampens and distorts the signal).

2. Select the shortest possible length of tubing to preserve signal strength and minimize motion artifact.

3. Follow your hospital procedures in assembling the tubing system.

STOP

WARNING: To avoid electric shock, do not use any conductive parts in the hydraulic system connection to the transducer.

Connect the IBP transducer to the IBP-connector on the monitor's left side panel.

IBP connector

Zeroing and Calibration Check

The **Zero** field in the IBP setup menu:

- Displays the date and time of the last zeroing procedure.

- Allows you to zero the pressure transducer before entering a calibration factor.

➤ **NOTE:** Before zeroing, make sure the transducer is at heart level. It is necessary to zero the transducer immediately after the introduction of the catheter in the patient's vascular system and before monitoring. You should also zero the transducer once a day or after changing the tubing or the dome of the transducer.

Pressure transducers are sensitive and their calibration may change significantly following a mechanical shock or an over-pressure in the system (e.g., after drawing blood or injecting drugs).

If you are using reusable transducers, it is necessary to calibrate them with a mercury manometer to determine the calibration factor. This calibration procedure is typically the responsibility of your Biomed.

The calibration check procedure described in this section consists of adjusting the monitor by entering the calibration factor given by your Biomed, if you are using reusable transducers.

If you are using disposable transducers, use 100 as the calibration factor. Disposable transducers are all pre-calibrated.

See the table on *Zero and Calibration Check Troubleshooting* (below) to help you during the procedure.

STEPS: Zeroing and Entering a Cal. Factor

1. Click on the IBP1 parameter box.

IBP1 Setup	
Label	ART
Zero	
Cal. Factor	100
Mano. Cal. (mmHg)	100
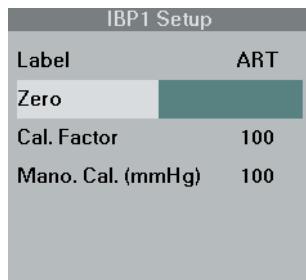
2. Re-align the transducer to the patient's heart level.

3. Close the transducer stopcock to the patient.

4. Open the venting stopcock to air (atmosphere). The monitor displays a flat waveform and a static IBP condition for the systolic (S) value.

5. Click on **Zero**.

6. Verify that the zero has been established. If zeroing failed, repeat steps 2 to 6. If zeroing is successful, continue.

7. If applicable, select **Cal. Factor** and click the knob.

8. Dial in the calibration factor and click the knob.

9. If you are monitoring two invasive blood pressures, repeat these steps for the second pressure parameter.

➤ **NOTE:** The monitor displays an error message (*IBP1 Cannot Zero* or *IBP2 Cannot Zero*) when zeroing fails. Call your Biomed or replace the transducer if zeroing fails after two attempts. If the monitor rejects the calibration factor that you selected, change the transducer or call your Biomed. The transducer needs to be calibrated.

Zero and Calibration Check Troubleshooting

Screen Message	Possible Cause	Suggested Action
IBP Cannot Zero, *IBP Zero Time-out*	• The transducer offset is outside the zero balance range of +/- 190 mmHg • The signal is too noisy. • The waveform is non static (more than 3 mmHg variation in 3 seconds). • The monitor was unable to zero the transducer within 10 seconds.	• Verify the pressure cable connection to the monitor. • Keep all tubing motionless. • Check the stopcock and verify that the system is open to air completely. • Repeat the zeroing procedure. • Replace the transducer if faulty.
IBP Invalid Cal	• The calibration factor is outside the range of 80 to 120 (inclusive).	• Replace the transducer if calibration fails after two attempts. • Call your Biomed to calibrate the transducer with a mercury manometer if calibration fails repeatedly. • Check the pressure cable for damage.
Note that instead of "IBP" the messages show the selected pressure label (e.g., "*ART Cannot Zero*").		

Calibrating Reusable Transducers

You must calibrate reusable invasive blood pressure transducers with the mercury manometer within five minutes after zeroing. Note: This procedure is for reusable transducers only.

STEPS: Calibrating the IBP Transducer

1. Zero the pressure transducer via the IPB setup menu.

2. Click on the IBP1 parameter box.

3. Click on **Mano. Cal.**

IBP1 Setup	
Label	ART
Zero	
Cal. Factor	100
Mano. Cal. (mmHg)	100

4. Connect the pressure transducer to the mercury manometer.

5. Pump the manometer to a value recommended by your hospital protocol.

6. Dial in the calibration value to match the mean pressure value and click the knob.

7. If you are monitoring two invasive blood pressures, repeat these steps for the second pressure parameter.

➤ **NOTE:** If invasive blood pressure alarms are on, the message *IBP static* appears.

17 Temperature

Overview

The monitor supports the use of temperature probes for oral, rectal and axillary applications. The monitor accepts one probe at a time and displays absolute temperature values in degrees Celsius ($^{\circ}$C) or in degrees Fahrenheit ($^{\circ}$F).

➤ **NOTES:**

■ Selecting the unit of measure is a password-protected function. See your Biomed for details.

■ When the monitor uses the export protocol to communicate with an external device, the temperature values in degrees Celsius ($^{\circ}$C) are transmitted as whole numbers without a decimal point on the external device. For example, a temperature value of 37.6 degrees is transmitted as 376.

To calculate a temperature value, the monitor averages the temperature signal over several seconds. The temperature label and measurement value appear above the first waveform channel. There is no waveform display for temperature.

Set T alarms on the Alarm Limits table (see the chapter *Alarms and Messages*). If you turn T alarms off, a crossed bell symbol appears next to the temperature value above the first waveform channel.

Temperature Probes

A wide selection of reusable and disposable thermistor probes is available. Use only Dräger-approved probes (see the appendix *Options and Accessories*); other probes are not recommended and may produce inaccurate measurement results.

Placing the Probe

Rectal Probes

To place the probe, follow the clinical techniques of your hospital. We also suggest the following:

1. Mark the insertion depth (2 to 4 inches) with a rubber ring or tape.

2. Insert the probe through the rectum into the colon and tape the cable in place.

➤ **NOTE:** Cover reusable probes with a protective rubber cover.

Axillary Probes

When esophageal or rectal probes cannot be used, a skin probe can give a good estimate of body temperature. For placement of the axillary probe, proceed as follows:

1. Place the probe under the axilla.

2. Tape it in place.

🛑 **WARNING: To prevent burns during electrosurgery, take the following precautions:**

- **Do not use surface probes.**

- **Use only sheathed rectal probes.**

🛑 **WARNING: Temperature probe protective covers contain latex.**

A Options and Accessories

This appendix lists Dräger-approved options and accessories for use with the Infinity Gamma Series monitors. To place an order, please contact your local Dräger representative.

Monitoring in the wireless network requires series access points and wireless LAN PC cards. To order components for wireless network operation, please contact the equipment manufacturer, Cisco Systems, Inc.

Options

ST Segment Analysis. 55 94 978 E533U

Second Invasive Blood Pressure Parameter (IBP2) 55 86 578 E533U

Neonatal OxyCardiorespirogram (OCRG) 55 86 586 E533U

Full Arrhythmia Monitoring 74 87 189 E551U

Fourth Display Channel (standard for Gamma XL) 74 87 171 E551U

Wireless Network Capability. 74 87 197 E551U

Pod Com Option/etCO$_2$ Monitoring (standard for Gamma XL).   59 51 855 E551U

Scio Multigas Monitoring (only for Gamma XL) . . . .   MS 13 205 E551U

Nellcor Sensor Compatibility 78 63 801 E551U

Masimo Sensor Compatibility. 78 63 793 E551U

MULTIMED/NEOMED Pods

MULTIMED 5™ pod 33 68 391 E530U
with large cable clip
  for ECG 3- and 5-lead patient cable,
  1 temperature probe,
  1 SpO$_2$ extension cable

MULTIMED 5 pod, short cable (1.5 m). 59 50 196 E530U

Cable clip, regular 47 18 495 E530U

Cable clip, large 33 68 789 E530U

NEOMED™ pod 55 90 539 E530U
with mount for attachment to incubator
  for ECG 3-lead Adapter Cable,
  1 temperature probe,
  1 SpO$_2$ extension cable

MULTIMED 6™ pod 51 91 221 E530U
  accommodates:
  ECG 3- 5-, and 6-lead patient cables
  1 Temperature probe
  1 SpO$_2$ extension cable

MULTIMED/NEOMED Holder 55 98 128 E530U

ECG

ESU Block

ECG ESU BLOCK. 59 47 226 E530U
  Must be used for patients monitored in OR

ECG Leads

IEC Color Code 1 is the European color scheme: 3-lead = RA red, LL green, LA yellow. For 5-lead, add: V white and RL black.

IEC Color Code 2 is the AHA/US color scheme: 3-lead = RA white, LL red, LA black. For 5-lead, add V brown and RL green.

ECG 3-lead grabber-set, IEC1 . . . . 59 56 433 E530U

ECG 3-lead grabber-set, IEC2 . . . . 59 56 441 E530U

ECG 5-lead grabber-set, IEC1, 1m. 59 56 466 E530U

ECG 5-lead grabber-set, IEC2, 1m. 59 56 458 E530U

ECG 6-lead grabber-set, IEC1 . . . . 59 56 482 E530U

ECG 6-lead grabber-set, IEC2 . . . . 59 56 474 E530U

ECG ADAPTER Cable, NeoMed pod (1.5 m) 55 92 162 E530U

Miscellaneous ECG

ECG electrodes, Neonatal, disposable, 300 pcs.. . . . .   51 95 024 E530U

ECG electrodes, disp., 50 pcs.. . . . .   45 27 750 EH405

ECG adhesive rings, large, 500 pcs. 45 23 742 EH405

ECG electrode cream. 45 37 197 EH405

Adapter pin for neonatal electrodes, package of 5. . . . .   51 94 779 E530U
    for use with MultiMed 5

Lead Set Housings (Adapter)

ECG 3-lead detect. Snap-On Holder 33 75 420 E530U

ECG 5-lead detect. Snap-On Holder.. . . . .   33 75 438 E530U

ECG 6-lead detect. Snap-On Holder.. . . . .   52 02 531 E530U

Pulse Oximetry (SpO$_2$)

➤   **NOTE:** Configuring the monitor for the use of Masimo or Nellcor sensors is a password-protected locked option. For more information, contact your Biomedical department.

Reusable Sensors

Nellcor DURASENSOR DS100A, adult 72 62 764 E530U
    SpO$_2$ adult sensor for finger or toe application
    Patient weight > 40 kg (88 lb.)

MASIMO LNOP-EAR, ...   74 97 006 E530U
    SpO$_2$ adult ear sensor with ear hanger
    Patient weight > 30 kg (66 lb.)

MASIMO LNOP-DCI, adult. 72 70 312 E530U
    SpO$_2$ adult sensor for finger or toe application
    Patient weight > 30 kg (66 lb.)

MASIMO LNOP-DCIP, pediatric 72 70 304 E530U
SpO$_2$ pediatric sensor for finger or toe application
Patient weight 10-50 kg (22-110 lb.)

MASIMO LNOP-YI, adult/pediatric/neonatal 74 97 014 E530U
SpO$_2$ multisite sensor
finger or toe application - Patient weight > 10 kg (22 lb.)
great toe application - Patient weight 3-10 kg (6.6-22 lb.)
across foot or palm and back of hand - Patient wt < 3 kg
(6.6 lb.)

MASIMO NR125, adult 72 70 361 E530U
SpO$_2$ adult sensor for finger or toe application
Patient weight > 30 kg (66 lb.)

Disposable Sensors

Nellcor OXISENSOR D-25/D-25L, adult, 24 pcs 45 34 434 EH50U
SpO$_2$ adult sensor for finger or toe application
Patient weight > 30 kg (66 lb.)

Nellcor OXISENSOR D-20, pediatric 24pcs 45 34 442 EH50U
SpO$_2$ pediatric sensor for finger or toe application
Patient weight 10-50 kg (22-110 lb.)

Nellcor OXISENSOR I-20, infant, 24 pcs 45 34 459 EH50U
SpO$_2$ infant sensor for finger or toe application
Patient weight 1-20 kg (2.2-44 lb.)

Nellcor OXISENSOR N-25, neonatal, 24 pcs 45 34 467 EH50U
SpO$_2$ neonatal sensor for foot application
Patient weight < 3 kg   (6.7 lb.)

MASIMO LNOPADT, adult 74 96 990 E530U
SpO$_2$ adult sensor for finger or toe application
Patient weight > 30 kg (66 lb.)

MASIMO LNOPPED, pediatric 74 96 982 E530U
SpO$_2$ pediatric sensor for finger or toe application
Patient weight 10-50 kg (22-110 lb.)

MASIMO LNOPNEO, neonatal 74 96 974 E530U
SpO$_2$ neonatal sensor for finger or toe application
Patient weight < 10 kg   (22 lb.)

MASIMO LNOPNEO SS, neonatal. 74 96 966 E530U
SpO$_2$ neonatal sensor for sensitive skin application
Patient weight < 10 kg   (22 lb.)

Extension Cables

SpO$_2$ Nellcor extension cable, shielded, blue latch, 1 m . . .   33 68 433 E530U

SpO$_2$ Nellcor extension cable, shielded, blue latch, 2 m . . .   33 75 834 E530U

SpO$_2$ mountable Masimo extension cable, 4.8 m 74 97 048 E530U

SpO$_2$ Masimo Procal+ cable, 2 m 74 92 601 E530U

End Tidal CO$_2$ (etCO$_2$)

etCO$_2$ pod 57 40 738 E547U
pod connection cable, 3 m; universal pole mount

etCO$_2$ pod, short cable (0.3 m) 72 57 988 E530U

PodPort upgrade 59 51 855 E551U
Upgrade option for Gamma/Gamma XL

Replacement Cables

Pod Connection Cable, 1 m 55 99 076 E530U

Pod Connection Cable, 3 m 33 68 425 E530U

Pod Connection Cable, 5 m 51 95 198 E530U

Mainstream Accessories

etCO$_2$ Capnostat III sensor, 2.4 m cable. 43 22 975 E530U
    etCO$_2$ airway adapter, adult
    Calibration and Reference Cell
    Cable clip, 5 each

etCO$_2$ Airway Adapter, adult 47 21 796 E530U

etCO$_2$ Airway Adapter, neonatal 47 21 788 E530U

Sidestream Accessories

etCO$_2$ S-Cannula, adult, 10 pcs 47 14 395 E530U

etCO$_2$ S-Cannula, pediatric, 10 pcs 47 14 387 E530U

etCO$_2$ Airway Adapter, sidestream, 10pcs 47 14 437 E530U

etCO$_2$ Nafion Tubing, 10pcs 47 14 429 E530U

Multigas

Scio Water Trap (set of 12) 78 68 123 E530U

Scio Sampling Line (set of 10) 78 68 115 E530U

Cables

Scio Connecting Cable, 0.3 m 78 76 670 E530U
    Cable to connect the Scio module to the monitor's inter-
    face plate or the Infinity Docking Station

Scio Connecting Cable, 2 m 78 75 607 E530U
    Cable to connect the Scio module to the monitor's inter-
    face plate or the Infinity Docking Station

Temperature

Adapter Cable

Temp adapter cable 51 98 333 E530U

STOP **WARNING: Temperature probe protective covers contain latex.**

Rectal Probes

Temp probe, adult, 1.5m 43 29 889 E530U

Temp probe, adult, 3m 52 04 644 E530U

Temp probe, pediatric, 1.5m. 43 29 848 E530U

Temp probe, pediatric, 3m 52 04 651 E530U

Temp protective covers, 10 pcs (latex). 70 14 616 F1703

Skin Probes

Temp skin probe, 1.5m. 43 29 822 E530U

Temp skin probe, 3m 52 04 669 E530U

Invasive Blood Pressure (IBP)

IBP transducer OHMEDA P10EZ reus. 43 21 548 E530U

IBP dome for OHMEDA P23XL/P23 XL-1 . . . .   43 50 559 E3012

IBP dome for OHMEDA P10EZ/P10EZ-1 . . . .   22 87 449 E3003

IBP transducer SensoNor 840, reus 43 21 555 E539U

IBP dome for SensoNor 840, 50 pcs 45 29 954 EH407

IBP transducer, OHMEDA, dispos., 5 pcs. 45 28 741 EH407

IBP intermediate cable, OHMEDA 33 75 933 E530U
*3.7m pressure intermediate cable to connect reusable/
disposable OHMEDA transducers to monitor*

IBP intermediate cable, SensoNor, 3.7m 43 21 563 E530U

IBP intermediate Y-Cable, Baxter, 3.7m 52 06 607 E530U

IBP intermediate Y-Cable, OHMEDA, 3.7m 52 06 581 E530U

IBP intermediate Y-Cable, Abbott/Medex, 3.7m 52 06 573 E530U

IBP intermediate Y-Cable, SensoNor, 3.7m 51 95 180 E530U

IBP mounting set for SensoNor (for 1 to 3 transducers) 45 29 962 EH407

IBP disposable set for SensoNor 840, 10 pcs 45 30 226 EH407

Three-way stopcock, Luer lock, sterile 45 01 342 EH016

Microcatheter, Luer-lock, sterile 45 01 359 EH016

Pressure cuff, for saline infusion solution 45 01 375 EH016

Basic element universal, mounting bracket. 45 27 206 EH407

Clamp for transducer (for OHMEDA P23 XL) 45 28 287 EH407

Mounting pin for transducer holder 45 28 295 EH407

Transducer holder (for 1 or 2 transducers), 10cm, 100 pcs .   45 28 303 EH 407

IBP-In-line flush device, 5 pcs. . . . .   45 27 321 EH 016
*Disposable flush device with 3ml/hour flow rate and over-
pressure relief.*

IBP-Adapter 10-pin to 7-pin 33 68 383 E530U
*connects pressure transducer cables with 10-pin orange
connectors to monitor's 7-pin shielded input connector.*

IBP Y-adapter, 10 pin to 7 pin 55 88 095 E530U

Non-invasive Blood Pressure (NBP)

Reusable Cuffs

NP cuff, child 12-19 cm 28 66 676 EH50U

NP cuff, small adult, 17-25 cm 28 66 635 EH50U

NP cuff, adult, 23-33 cm. 28 66 643 EH50U

NP cuff, large adult, 31-40 cm 28 66 650 EH50U

NP cuff, thigh, 38-50 cm. 28 66 668 EH50U

NP cuff, neonatal #1,3.1-5.7 cm. 28 70 181 EH50U

NP cuff, neonatal #2, 4.3-8.0 cm 28 70 199 EH50U

NP cuff, neonatal #3, 5.8-10.9 cm 28 70 207 EH50U

NP cuff, neonatal #4, 7.1-13.1 cm 28 70 215 EH50U

NP cuff, neonatal #5, 8.3-15.0 cm 28 70 173 EH50U

NP connection hose, 3.7m. 12 75 275 EH50U

NP connection hose, neonatal, 2.4m 28 70 298 EH50U

Power Sources

AC Power adapter (34 W) 59 53 539 E530U

Gamma Series battery charger 47 10 211 E530U

Gamma Series Replacement battery 59 47 697 E533U

Gamma Series Lithium Ion battery. 57 32 354 E533U

Power Cords

Power Cord Cont. Europe, CEE7	43 21 712 E530U
Power Cord North America, 5-15R	43 21 720 E530U
Power Cord Australia, China and New Zealand, AS 3112 . .	43 21 662 E530U
Power Cord Great Britain, AS 1363	43 21 654 E530U
Power Cord Switzerland, SEV 1011	43 21 613 E530U

Options

Interface plate	33 76 493 E530U
Infinity DOCKING STATION (IDS)	52 06 110 E546U
Infinity DOCKING STATION (IDS), INTERFACE AND POWER	57 32 388 E530U
Infinity DOCKING STATION (IDS), POWER	55 93 509 E530U
Infinity DOCKING STATION (IDS), POWER	72 65 130 E530U
Infinity DOCKING STATION Power Supply, 120V . . . . Includes 2.5 m DC cable	55 84 912 E530U
Infinity DOCKING STATION Power Supply, 220V . . . . Includes 2.5 m DC cable	59 49 271 E530U
Infinity DOCKING STATION Power Supply with Switch Selectable 120V/220V . . . . Includes 2.5 m DC cable. Can be used as a direct replacement for the Dräger IDS Power Supplies 55 84 912 E530U and 59 49 271 E530U. **Note**: Refer to the Installation instructions for proper use of the switch feature.	59 55 393 E530U
DC Cable 6M for IDS . . . . 6.0 m DC power cable for remote installation or repair/ replacement	55 91 313 E530U
Mounting DOCKING STATION™ . . . . *mount only, no connections for standalone applications*	47 15 319 E530U

Displays and Display Components

Planar Video Display

15-inch Planar D6015TM. 59 55 567 E531U
A 15-inch Flat Panel display that replicates the screen of the bedside monitor

Adapter Cable, 3 m 47 26 084 E530U
Cable to connect the 15-inch Planar Remote Display to a Communication Power Supply (CPS), Infinity Docking Station (IDS) or interface plate

Adapter Cable, 25 m 51 94 910 E537U
Cable to connect the 15-inch Planar Remote Display to a Communication Power Supply (CPS), Infinity Docking Station (IDS) or interface plate

Sony Video Display

15-inch Sony PGM-100P1MD 57 35 894 B531O
A 15-inch remote display that replicates the screen of the bedside monitor

Adapter Cable, 2 m (15 Pin D to RGB) 57 38 716 E530U
Cable to connect the 15-inch Sony Remote Display to a Communication Power Supply (CPS), Infinity Docking Station (IDS) or interface plate

Adapter Cable, 1 m (required). 57 36 199 E530U
Cable to connect the above adapter to a Communication Power Supply (CPS), Infinity Docking Station (IDS) or interface plate

Adapter Cable, 5 m (required). 57 36 181 E530U
Cable to connect the 15-inch Sony Remote Display to a Communication Power Supply (CPS), Infinity Docking Station (IDS) or interface plate

Adapter cable, 8 m (required) 57 36 165 E530U
Cable to connect the 15-inch Sony Remote Display to a Communication Power Supply (CPS), Infinity Docking Station (IDS) or interface plate

Adapter cable, 23 m (required) 57 36 173 E530U
Cable to connect the 15-inch Sony Remote Display to a Communication Power Supply (CPS), Infinity Docking Station (IDS) or interface plate

Wall Mount 47 20 152 E530U
> *Mount for 15-inch Remote Display; with 33 cm (13-inch) extension arm. Adjustable height on a 48 cm (19-inch) vertical track.*

Recorder

R50 Universal Recorder 59 52 630 E527U

R50 Network Recorder 57 40 068 E550U

R50 Monitor Cable, 0.6 m 47 12 993 E550U

Recorder/Alarm Output Y-cable 43 13 578 E530U

R50 Monitor Mount Bracket 47 20 145 E530U

R50 Recorder Paper, box of 10 rolls 47 11 201 E527U

Mounting Devices

Shelf Mount 47 20 087 E530U

Bed Rail Mount 51 88 813 E530U

Wall Mount with 38 cm arm 57 29 905 E530U

Wall Mount Box 88 34 616 E2513

Pick&Go Easy-Arm Mount 72 59 034 E530U

Handle Hook Mount 55 94 440 E533U

Mount Plate PGEA GCX 72 62 129 E530U

Mount Plate PGEA Westbrook 72 62 137 E530U

Rolling Stand 47 22 240 E530U

IDS/CPS Power Supply Wall Mount 47 20 061 E530U

IDS/CPS Power Supply Wall Bracket 47 20 129 E530U

IDS/CPS Power Supply Rail Mount 47 20 095 E530U

IDS/CPS Power Supply Rollstand Bracket. 47 20 103 E530U

Docking Station Wall Mount . . . . '   47 20 111 E530U

Docking Station Clamp Mount 47 20 079 E530U

Mounting Plate Sony PGM. 57 38 476 E530U

Mounting Plate Planar 6015TM 59 56 920 E530U

Miscellaneous

Data Memory PC Card, 2 MB. 47 18 248 E522U

Alarm Output Cable, IDS/CPS, 5 m 51 94 928 E530U

Alarm Output Cable with Relay 43 14 626 E530U

Infinity QRS Synchronization Output Cable, 3 m 43 14 667 E530U

Velcro Straps (to organize cables) 52 06 227 E530U

RS232 Diagnostic UART cable, 3 m 47 14 346 E530U

Export Protocol Cable, CPS/IDS, 3 m 52 06 441 E530U

B Cleaning, Disinfecting, Sterilizing

Cleaning, Disinfecting and Sterilizing

Clean the monitor and all accessories after each patient or daily according to your hospital's standard procedures. We recommend the following cleaning solutions and procedures.

⚠️ **CAUTION:** *Do not use disinfectants that contain phenol as they can spot plastics.* **Do not autoclave** *or clean accessories with strong aromatic, chlorinated, ketone, ether, or ester solvents. Never immerse electrical connectors.*

Monitor

- Clean the monitor with a gauze moistened in a soap solution.

- Dry thoroughly with a lint-free cloth.

⚠️ **CAUTION:** *The material used for the monitor's enclosure is a highly resistant thermoplastic. Do not use plastic solvents, sharp tools or abrasives to clean it.*

- Disinfect the monitor with a gauze moistened with diluted alcohol or a gluteraldehyde-based disinfectant.

⚠️ **CAUTION:** *Do not steam autoclave, gas sterilize, or immerse the monitor in water or cleaning solutions. Do not subject the monitor to intense vacuum.*

- Dry thoroughly with a lint-free cloth.

Patient Cables

- Clean the patient cables with a gauze pad moistened with a soap solution.

- Dry thoroughly with a lint-free cloth.

- To disinfect patient cables, wipe the cables with a gauze moistened with diluted alcohol or a gluteraldehyde-based disinfectant.

- Dry thoroughly with a lint-free cloth.

- Sterilize the ECG patient cables at temperature below 70°C.

Reusable ECG Electrodes

- Clean grabber-wire clips regularly with a toothbrush.

- Remove any gel residue from the electrode by brushing it off under running water.

- Clean the electrodes with a gauze moistened with a soap solution.

- Dry thoroughly with a lint-free cloth.

- Disinfect the electrodes with a gauze moistened with diluted alcohol or a gluteraldehyde-based disinfectant.

- Dry thoroughly with a lint-free cloth.

Reusable SpO$_2$ Sensor

See the cleaning instructions and recommendations provided with the sensor.

NBP Cuff

Wipe the NPB cuff with a cloth moistened with soap and water or a solution based on household bleach (1:10), gluteraldehyde, alcohol, or phenol.

⚠ **CAUTION:** *The NBP cuff can be immersed in cleaning solution, but do not allow the solution to enter the NBP hose. The warranty is void if cleaning solution is allowed to enter the hose or the cuff.*

Temperature probes and cables

- Do not use excessive pressure or flex the cables as this can stretch the covering and break the internal wires

- Clean the probes with a 3% hydrogen peroxide or 70% alcohol

- Quickly immerse the cables in a detergent solution

- Disinfect probes and cables with a gluteraldehyde-based disinfectant

- Make sure the probe's tip is firmly connected.

⚠ **CAUTION:** *Do not use phenol disinfectants because vinyl absorbs them. Do not use strong aromatic, chlorinated, ketone, ether or ester solvents. Do not immerse the cables for any prolonged period in alcohol, mild organic solvents, or highly alkaline solutions.*

STEPS: Sterilizing with ethylene oxide

1. Clean probe and coil the cable loosely before packaging it.

2. Follow standard hospital procedures and sterilize at a temperature not exceeding 45 °C.

3. After sterilization, follow standard degassing procedure and aerate the probe for 24 hours.

⚠️ *CAUTION: Never boil or autoclave the cable. Vinyl withstands temperatures up to 100 °C but begins to soften at around 90 °C. Handle gently when hot and wipe away from the tip toward the cable.*

Reusable Pressure Transducers and Cables

⚠️ *CAUTION: Observe the following precautions when cleaning or sterilizing all pressure accessories.*

- *Avoid applying excessive pressure to a transducer diaphragm.*
- *Use disposable pressure accessories only once and then discard them.*
- *Do not subject transducers to water, steam, hot air sterilization, ether, chloroform, or similar chemicals.*
- *Always protect the connector from moisture.*
- *Inspect the cable. Replace it if cracked.*
- *Store transducer cables loosely coiled at temperatures below 50°C.*

STEPS: Cleaning Transducer and Diaphragm

1. Remove and clean the plastic dome with soap or a detergent solution using a pipe cleaner or brush. Rinse it thoroughly.

2. Clean blood and foreign material from external surface of the transducer and cable.

3. Dip the diaphragm in a blood solvent such as hydrogen peroxide. If you soak the transducer, cover the diaphragm with the dome.

4. Rinse the transducer thoroughly with distilled water.

STEPS: Sterilizing with Ethylene Oxide

1. Clean the transducer and dome.

2. Loosely coil the cable before packaging it.

3. Sterilize at a temperature not exceeding 45°C following your hospital procedures.

4. After sterilization, follow standard degassing procedure and aerate the probe for 24 hours.

STEPS: Sterilizing with Fluid

1. Clean the transducer and replace the dome.

2. Place the transducer and dome in a gluteraldehyde-based solution.

3. Fill the dome completely but do not introduce bubbles.

4. Immerse the transducer and the dome for at least 10 hours to destroy resistant pathogenic spores. An immersion of less than 10 hours will disinfect but not sterilize the equipment.

5. Using sterile techniques, remove the accessories from the fluid and rinse them thoroughly with sterile water at least three times.

6. Coil the transducer loosely.

7. Pack the accessories in a sterile container and label it "fluid sterilized".

See also the instructions and recommendations provided with the transducer.

Cleaning etCO$_2$ Pod and Accessories

There are several accessories used with the etCO$_2$ pod, each with its own cleaning requirements.

Capnostat Sensor

Clean the sensor surfaces, including the sensor windows, with a damp cloth. Dry with a clean, lint-free cloth, making sure the sensor windows are clean and dry. Never immerse the sensor or attempt to sterilize it.

ReusableAirway Adapters

Rinse airway adapters in a warm soapy solution, then soak them in a liquid disinfectant or in pasteurized or cold-sterilized glutaraldehyde. After the adapters are cleaned and sterilized, rinse thoroughly inside and out with sterile water. Dry with lint-free cloth. Make sure adapter windows are dry and free of any residue.

Airway adapters can be sterilized in a steam autoclave or using ethylene oxide (ETO) gas methods. Use appropriate aeration times.

Nasal Sampling Cannulas and Tubing

Cannulas and tubing are for single-patient use only. Dispose of used cannulas and tubing following your institution's policy.

Sidestream Sampling Pump

The etCO$_2$ pod contains a small pump that draws air from the nasal cannula, through the sidestream airway adapter, and out the exhaust port on the etCO$_2$ pod. The internal parts of this pump are subject to contamination by exhaled secretions and must be regularly cleaned and sterilized by flushing a cleaning/sterilization solution through the pump in the etCO$_2$ pod.

Preparatory Steps

The following fluids are acceptable for cleaning/sterilization:

- Isopropyl alcohol.
- A 5.25% water solution (by weight) of sodium hypochlorite (bleach).
- A locally approved sterilant.

In addition, you need the following items:

- A 60 cc catheter-tip syringe.
- A 2-foot section of 1/8- or 3/16-inch tubing to drain off fluid after it passes through the $etCO_2$ pump.
- A receptacle to receive the fluid after it drains from the $etCO_2$ pod.

CAUTION: *Always use a syringe to flush cleaning and sterilizing solutions through the pump as described in the instructions below. Do not attempt to use the sidestream sampling pump itself to move cleaning or sterilizing solutions through the system. This may cause accelerated wear on the pump bearings.*

Setting up the Monitor and $etCO_2$ Pod

To set up the monitor and the $etCO_2$ pod:

1. Set $etCO_2$ measurement mode to **Side** (for Sidestream monitoring).
2. Remove the $etCO_2$ cartridge from the monitor.
3. Remove all sidestream sampling tubing from the pod connectors.
4. Attach the section of 1/8- or 3/16-inch tubing to the pod's exhaust port, and run it to a drainage receptacle placed below the pod.

Cleaning/Sterilizing Procedure

To clean and sterilize the sidestream pump:

1. Fill the 60cc catheter-tip syringe with cleaning/sterilizing fluid, and fix it to the sidestream input connector on the $etCO_2$ pod.

2. Flush the fluid slowly through the pumping system and out through the tubing connected to the exhaust port. Repeat two more times for a total of 180cc of fluid.

3. Remove the syringe. Leave remaining fluid in the pumping system for 30 minutes. This disinfects the system. If you are using a locally approved sterilant, follow the manufacturer's instructions for sterilization times.

4. After 30 minutes, fill the syringe with distilled water and flush through the system. Repeat two more times.

5. Empty the syringe and use it to push several volumes of air slowly through the system. This clears most of the sterilization solution from the pump.

6. Remove the syringe from the pod, but keep the drain tubing in place.

Drying the Sidestream Pump Subsystem

After you have cleaned, sterilized, and removed most of the fluid, it is important to dry the pump subsystem completely.

To dry the sidestream pump subsystem:

1. Re-attach the $etCO_2$ pod to the monitor. The sidestream sampling pump starts running, and there is suction at the input port on the face of the pod.

➤ **NOTE:** If the sidestream pump fails to start, make sure the capnostat sensor is disconnected. The pump is designed to shut down while a connected sensor is warming up.

2. With the input sidestream port still open and the drain tubing still connected, let the pump run for several minutes to remove any water still trapped in the system.

3. Block the sidestream input port with your finger for several seconds and then unblock it. Repeat at least ten times.

4. Move your finger to the sidestream output port and block the port with your finger for several seconds and then unblock it. Repeat at least ten times.

5. Remove the drain tubing, and allow the sidestream pump to continue running for at least 30 minutes.

Scio Module and Accessories

STOP

WARNINGS:

■ **Occupational safety hazared: Used sampling tubing, T-connectors, and water traps could be contaminated and must be handled and disposed of with care. Infection hazard may be present. Dispose of these items in accordance with local regulations.**

■ **Because of the danger of electric shock, never remove the cover of any device while it is in operation or connected to a power outlet.**

Emptying the Water Trap

The water trap should be emptied if the contents has reached the 'full' mark. To empty the water trap:

1. Disconnect the sampling tubing.

2. Remove the trap from its receptacle by holding it firmly on the ridged surfaces and pulling it out from the Scio module.

3. Connect an empty syringe (size > 20 ml without a needle) to the port on the back of the water trap.
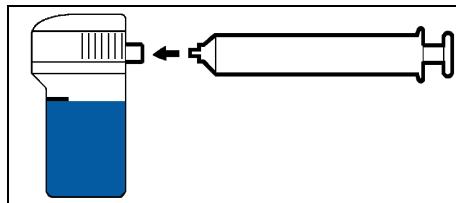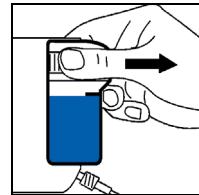
4. Pull water trap contents into the syringe.

5. Remove syringe and discard.

➤ **NOTE:** Do not clean the water trap. If the water trap seems dirty or if it has been in use for 4 weeks, replace it.

Cleaning/Replacing the Fan Filter

The fan filter should be cleaned once per month and replaced at least once a year.

STEPS: Cleaning/Replacing the Fan Filter

1. Grasp the fan filter and remove it from its holding slots on the back of the module.
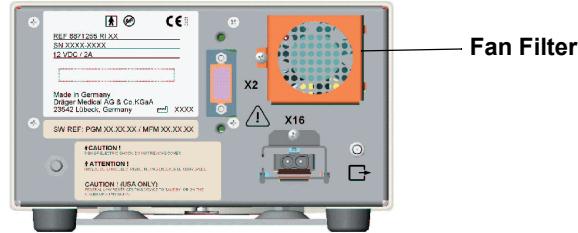
Fan Filter

2. Vacuum up any accumulation of dust at the fan port and inside the filter (if reusing the filter).
3. Reinsert the cleaned fan filter or a new filter.

C Default Settings and Biomedical Support

Default Settings

The first section of this appendix list the default settings for the monitor. These settings are programmed into the monitor as you receive it from the factory, and are used by the monitor until the user changes them. The first three columns in the following table show these settings for adult, pediatric, and neonatal monitoring modes.

After discharging a patient to admit a new patient, most settings, called patient settings, are remembered by the monitor while others return to their factory defaults. If the user chooses to save the current patient setup, many factory settings *are changed to* patient settings, and will be active for the next patient of that category. Whether or not a setting returns to its factory default between patients or can be saved as a monitoring configuration is noted in the following table.

➤ **NOTES:**

- Alarm Limits, Alarm On/Off, and Record On/Off settings are considered Patient Settings for all parameters except where noted.

- Some settings are for optional features and are only available on units with these options installed or enabled.

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
ECG				
Alarm	On	On	On	Saved Setup
Alarm Limits (upper/lower)	120/45	150/50	180/80	Saved Setup
Alarm Recording	Off	Off	Off	Previous Patient
Tone Source	ECG	ECG	ECG	Previous Patient
Tone Volume	Medium	Medium	Medium	Previous Patient
Pacer Detect	Off	Off	N/A	Saved Setup
QRS Marks	Off	Off	Off	Factory
ECG Processing	ECG 1&2	ECG 1&2	ECG 1	Previous Patient
ECG Leads	5-Lead	5-Lead	3-Lead	Previous Patient
Arrhythmia*				
ASY, VF, VT, RUN, AIVR, SVT, CPT, BGM Alarm	On	On	n/a	Saved Setup
BRDY, TACH, PAUS, ARTF Alarm	Off	Off	n/a	
ASY and VF Alarm Recording	Record	Record	n/a	Saved Setup
Other Events	Off	Off	n/a	
Arrhythmia Monitoring	Basic	Basic	n/a	Saved Setup
*Not applicable for neonatal monitoring.				

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
ST Segment Analysis*				
ST Measurement Point	Beat offset +80ms	Beat offset +80ms	n/a	Factory
ST Isoelectric Point	Beat onset -28ms	Beat onset -28ms	n/a	Factory
ST Alarm	Off	Off	n/a	Saved Setup
Alarm Limits (upper/lower)	+1.0mm/ -1.0mm	+1.0mm/ -1.0mm	n/a	Saved Setup
Alarm Recording	Off	Off	n/a	Previous Patient
*For Adult and Pediatric monitoring only. All values shown apply to both ST<lead1> and ST<lead2>.				
Respiration				
Alarm	Off	Off	On	Saved Setup
Alarm Limits (upper/lower)	30/5	80/20	80/20	Saved Setup
Alarm Recording	Off	Off	Off	Previous Patient
Rsp Mode	Auto	Auto	Auto	Saved Setup
Rsp Marker	Off	Off	On	Saved Setup
Apnea Time	Off	Off	15 seconds	Saved Setup
Coincidence Alarm	Off	Off	On	Saved Setup
etCO$_2$				
Alarm	Off	Off	Off	Saved Setup
Alarm Limits (upper/lower)	50/30	50/30	50/30	Saved Setup
Alarm Recording	Off	Off	Off	Previous Patient

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
Insp. Agent	0	0	0	Previous Patient
Exp. Agent	0	0	0	Previous Patient
Balance	Air	Air	Air	Previous Patient
Averaging	20s	20s	20s	Previous Patient
Meas. Mode	Main	Main	Main	Saved Setup
RRc Apnea	Off	15 seconds	15 seconds	Saved Setup
Atm. Press. Mode	Auto	Auto	Auto	Saved Setup
iCO_2 Alarm	Off	Off	Off	Saved Setup
iCO_2 Alarm Limits (upper/lower)	4/0	4/0	4/0	Saved Setup
RRc Alarm	Off	Off	On	Saved Setup
RRc Alarm Limits (upper/lower)	30/5	60/20	60/20	Saved Setup
* Displayed only if $etCO_2$, ST and IBP2 locked options are enabled.				

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
Multigas				
Alarm	Off	Off	n/a	Saved Setup
Alarm Recording	Off	Off	n/a	Saved Setup
Alarm Limits in vol% (upper/lower)	iO_2: 18/100 etO_2: 10/100 i/etHal, i/etISO, i/etENF: 0/6 i/etSEV: 0/9 i/etDES: 0/20	iO_2: 18/100 etO_2: 10/100 i/etHal, i/etISO, i/etENF: 0/6 i/etSEV: 0/9 i/etDES: 0/20	n/a	Saved Setup
Agent Override	Off	Off	n/a	Previous Patient
Autozero Delay	5 min	5 min	n/a	n/a
SpO_2				
Alarm	Off	Off	Off	Saved Setup
Alarm Limits (upper/lower)	100/90%	100/90%	95/85%	Saved Setup
Alarm Recording	Off	Off	Off	Previous Patient
Tone Source	ECG	ECG	ECG	Previous Patient
Tone Volume	Medium	Medium	Medium	Previous Patient
Bar Graph	Off	Off	Off	Previous Patient
Averaging	Normal	Normal	Normal	Previous Patient

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
PLS Alarm Limits (upper/lower)	120/45	150/50	170/80	Saved Setup
Temperature				
Alarm	Off	Off	Off	Saved Setup
Alarm Limits (upper/lower)	39/34 °C 102.0/93.2 °F	39/34 °C 102.0/93.2 °F	39/34 °C 102.0/93.2 °F	Saved Setup
Alarm Recording	Off	Off	Off	Previous Patient
Units	°C	°C	°C	Previous Patient
NBP				
Alarm	Off	Off	Off	Saved Setup
Alarm Limits (upper/lower) • Systolic • Mean • Diastolic	• 160/90 • 125/60 • 110/50	• 160/90 • 125/60 • 110/50	• 80/50 • 70/40 • 60/25	Saved Setup
Alarm Recording	Off	Off	Off	Previous Patient
Interval Mode	Off	Off	Off	Saved Setup
Calibration Mode	Off	Off	Off	Previous Patient
Inflation Mode	Adult:270	Ped.: 180	Neo.: 90	Previous Patient
Measurement Tone	Off	Off	Off	Saved Setup

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
IBP1, IBP2				
Alarm	Off	Off	Off	Saved Setup
Alarm Limits (upper/lower) • Systolic • Mean • Diastolic	 • 160/90 • 125/60 • 110/50	 • 160/90 • 125/60 • 110/50	 • 120/50 • 85/40 • 80/35	Saved Setup
Alarm Recording	Off	Off	Off	Previous Patient
Cal. Factor	100	100	100	Previous Patient
Manometer Cal.	100	100	100	Previous Patient

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
Channel 1				
Waveform	ECG II	ECG II	ECG II	Saved Setup
Size	ECG: 1mV/cm SpO_2: 50%	ECG: 1mV/cm SpO_2: 50%	ECG: 1mV/cm SpO_2: 50%	Saved Setup
Channel 2				
Waveform	Rsp	Rsp	Rsp	Saved Setup
Size	ECG: 1mV SpO_2: 50% Rsp: 50% IBP1, IBP2: 0-200 mmHg $etCO_2$*: 40	ECG: 1mV SpO_2: 50% Rsp: 50% IBP1, IBP2: 0-200 mmHg $etCO_2$: 40	ECG: 1mV SpO_2: 50% Rsp: 50% IBP1, IBP2: 0-100 mmHg $etCO_2$: 40	Saved Setup
* If all the options are enabled, the etCO2 waveform replaces the Rsp waveform (if etCO2 is connected).				
Channel 3				
Waveform	SpO_2	SpO_2	SpO_2	Saved Setup
Size	SpO_2: 50% Rsp: 50% IBP1, IBP2: 0-200 mmHg	SpO_2: 50% Rsp: 50% IBP1, IBP2: 0-200 mmHg	SpO_2: 50% Rsp: 50% IBP1, IBP2: 0-100 mmHg	Saved Setup

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
Channel 4*				
Display	Parameter Boxes	Parameter Boxes	Parameter Boxes	Saved Setup
OR Mode Display*	$etCO_2$ waveform plus CO_2 and Multigas parameter boxes	$etCO_2$ waveform plus CO_2 and Multigas parameter boxes	n/a	n/a
$etCO_2$ waveform size	5	5	5	Saved Setup
* A 4th display channel is standard for monitors Gamma XL, optional for monitors Gamma. The OR mode is not available for monitors Gamma.				
Main Menu				
Patient Category	Adult	Pediatric	Neonate	Previous Patient
Botton Channel	All	All	All	Saved Setup
OR Mode (option)	Off	Off	n/a	Previous Patient
Show Rsp/$etCO_2$	$etCO_2$	$etCO_2$	$etCO_2$	Previous Patient
Date & Time	current	current	current	Previous Patient
Speaker Volume	Medium	Medium	Medium	Previous Patient
Alarm Light	ON	ON	ON	Previous Patient
Alarm Groups	50	50	50	Previous Patient
Trend Setup	HR, SpO_2, NBP	HR, SpO_2, NBP	HR, SpO_2, NBP	Saved Setup

	Adult Settings	Pediatric Settings	Neonatal Settings	After patient discharge, settings return to...?
Biomed (password-protected settings)				
Units • T • etCO$_2$ • etCO$_2$ in OR mode* • Pressures • ST*	• °C • mmHg • vol % • mmHg • mm	• °C • mmHg • vol % • mmHg • mm	• °C • mmHg • n/a • mmHg • mm	Previous Patient
*The OR mode is available as an option for monitors Gamma XL in adult and pediatric monitoring modes. ST segment analysis is available as an option for monitors Gamma and Gamma XL in the adult and pediatric monitoring modes.				
Service: Monitor Setup (password-protected settings)				
Language	English	English	English	Previous Patient
SCIO Port	X5	X5	--	Previous Patient
Data Collection	Off	Off	Off	Previous Patient
Line Frequency	60 Hz	60 Hz	60 Hz	Previous Patient
Locked Options (password-protected settings)				
• ST • Demo • OCRG • IBP2 • etCO$_2$ • 4th Channel • Full Arrhythmia • Wireless • SpO$_2$ sensor • Multigas	• Disable • Disable • Disable • Disable • Disable • Disable • Disable • Disable • Masimo • Disable	• Disable • Disable • Disable • Disable • Disable • Disable • Disable • Disable • Masimo • Disable	• Disable • Disable • Disable • Disable • Disable • Disable • Disable • Disable • Masimo • n/a	Previous Patient

Biomedical Support

This section of the appendix is designed for the Biomedical personnel of your hospital. It includes an overview of the Biomed menu, basic setup, saving setups, diagnostic functions, and calibration check procedures for NBP. This appendix is not a substitute for the Infinity Gamma Series Service Manual that is available from Dräger.

⚠ *CAUTION: Verify that the monitor's line frequency under the "Service" menu is set to match the 50 or 60 Hz mains power line frequency of your hospital. The line frequency determines the center frequency of the ECG notch filter. The filter greatly reduces line frequency noise on the ECG waveform. Refer to the Service manual for details how to change frequency.*

Startup Tests

The monitor runs internal tests continuously and upon power up to check various functions, as well as the integrity of both ROM and RAM memories. If any of the tests fail, the monitor resets and displays a message (see the following table). The test results are recorded in the Diagnostic Log.

If the same error is detected three times in succession within 10 minutes without any other intervening errors, the monitor stops resetting and generates a loud, continuous error tone. If this happens, take the unit out of operation and call DrägerService.

➤ **NOTE:** The monitor stores patient data and settings in an internal battery backed-up memory. If any of the following messages appear frequently, the internal battery needs to be changed.

Message	Test
Default Patient Settings Restored	Integrity of patient data settings.
Software Reset, See Diagnostic Log	The software has previously detected and logged a fault condition. See the Diagnostic log for the exact cause of the reset.
Replace Battery Pack	Battery <25%.
Check Internal Battery	Assure integrity of patient data and/or settings.
Calendar Clock Reset	Invalid clock setting at startup.
Low Battery Reset	Voltage < 10V.
High Temperature Reset	Internal temperature > 64°C.
NBP Fault	Integrity of the NBP pneumatic constants.
Patient Data Erased	Integrity of patient data.

Checking the NBP Calibration

The **NBP** parameter box gives you access to the NBP Calibration mode. These checks must be performed in Adult Mode only.

STEPS: NBP Calibration

1. Click on the **NBP** parameter box.

2. Click on **Calibration Mode**.

NBP Setup	
Interval Mode	OFF
Calibration Mode	ON
Inflation Mode	Adult:270
Measurement tone	ON

3. Select **ON** and click the knob.

4. Replace the cuff with a mercury manometer.

5. Pump the manometer until the mercury column reads 260 mmHg. Verify the displayed value on the monitor.

6. Release the pressure and read the pressure value at three different points on the mercury column: the displayed values on the monitor should be within ±3 mmHg of the manometer readings.

7. Close the release valve on the bulb and pump the manometer until the overpressure release valve opens. This should happen at 300 mmHg ±30 mmHg and the mercury column should fall rapidly to zero. If the release valve does not open or if it opens at a value lower than 300 mmHg ±30 mmHg, the overpressure system may be faulty. Remove the monitor from service and contact DrägerService.

➤ **NOTE:** If the monitor is left in the calibration mode for more than 128 seconds after a first measurement has been started, an *NBP Fault* condition is reported. This message does not indicate a hardware failure but the activation of the safety timer of the monitor. To clear the message, turn the monitor off, then on again.

Biomed Menu

The Biomed menu gives you access to basic setup and maintenance tasks. The Biomed and the Service menus are password-protected. The Biomed menu gives you access to the following functions:

- **Save Setups** — to save the current configuration of alarm limits and display options.

- **Locked Options** — to activate the demo mode and optional features of the monitor. Each option requires a password to unlock.

- **Diagnostic Logs** — to display and to print the diagnostic log.

- **Units** — to change the units that Temperature, etCO$_2$, Pressures and ST segment analysis use.

- **Service** — to access various service functions, including **Update Software**, **Test Pulse**, **Monitor Setup** (Language, SCIO Port, Data Collection, Line Frequency), and **Network Setup** (Network Configuration, Network Information). Access to this menu requires entering the Service password.

Saving a Patient Setup

You can save and re-use the current monitoring configuration. This saved configuration is automatically restored when a new patient of the same category (e.g., pediatric) is admitted.

The monitor saves the following settings: Waveform channel assignments and scales, alarm limits and on/off status, IBP pressure labels, arrhythmia monitoring settings (adult or pediatric mode only), respiration mode and markers, apnea time, coincidence alarm, $etCO_2$ measurement mode, and pacemaker setting and detection.

STEPS: Saving a Patient's Setup

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Biomed**.

Main Menu			
Review	→ Main Screen	▯ Save Setups	▯
Admit/Discharge	→ Monitor Options	→ Locked Options	▯
Monitor Setup	→ Trend Setup	▯ Diagnostic Logs	▯
Standby	▯ Recordings	▯ Units	▯
	Biomed	→ Service	▯
	Alarm Groups	▯ Exit	←
	Exit	←	
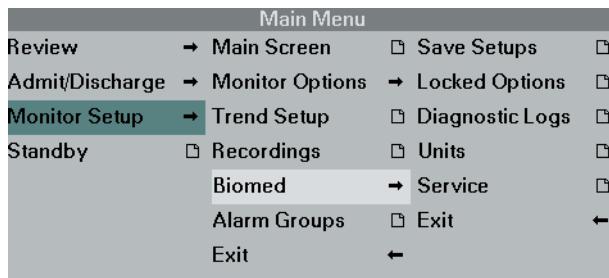
4. Dial in the Biomed password and click the knob.

5. Click on **Save Setups**.

6. Click on **Save Setup**, select **Confirm** (or **Cancel**) and click the knob.

The monitor saves the current monitoring setup for future use. The setup is available even after the current patient has been discharged from this monitor.

➤ **NOTE:** You cannot save a setup when an OCRG is displayed on the screen. Exit the OCRG display before saving.

Locked Options and Demo Mode

The Locked Options menu gives you access to the Demo mode and to a number of monitoring options that are available for purchase. These options and their order numbers are listed in the appendix *Options and Accessories*.

Using the Demo Mode

The monitor provides a demonstration mode to allow the presentation of features and functions during a product introduction. Before demonstrating or testing the monitor, disconnect all patient cables from the monitor.

➤ **NOTE:** In Demo mode, the All Alarms Off key is without function and creates an error tone when pressed.

STEPS: Enabling the Demo Mode

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Biomed**.

4. Enter the Biomed password and click the knob.

5. Click on **Locked Options**.

6. Click on **Enable Option**.

7. Select **Demo** and click the knob.

Upon entering the demo mode, all previous patient data is erased. A yellow banner *Simulated Data* appears on the screen, along with parameter values and waveforms. If the monitor is connected to the network, the central station shows the bed as *Simulated Data* and the Admit function at the central station is disabled.

STOP **WARNING: If the monitor is connected to the network, alarms generated by the monitor during simulation are transmitted to the MultiView Workstation.**

To disable the Demo Mode, turn the monitor off and on again or enter the Standby mode and discharge the patient upon resuming monitoring.

➤ **NOTES:**

■ Patient data transfer across the network of simulated data is not possible.

■ If the monitor is connected to the network, disabling the demo mode at the bedside clears all data at the MultiView Workstation.

Diagnostic Logs

The diagnostic log records major changes that occur in the monitoring environment, as well as operational errors.

The diagnostic log stores the most recent 200 errors or conditions, along with date and time of the occurrence. The most recent messages are displayed first. Turn the rotary knob to scroll through all entries. The codes that appear in the log help DrägerService identify the cause of error or condition.

STEPS: Displaying the Diagnostic Log

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Biomed**.

4. Enter the Biomed password and click the knob.

Main Menu			
Review	➜ Main Screen	▯ Save Setups	▯
Admit/Discharge	➜ Monitor Options	➜ Locked Options	▯
Monitor Setup	➜ Trend Setup	▯ Diagnostic Logs	▯
Standby	▯ Recordings	▯ Units	▯
	Biomed	➜ Service	▯
	Alarm Groups	▯ Exit	←
	Exit	←	
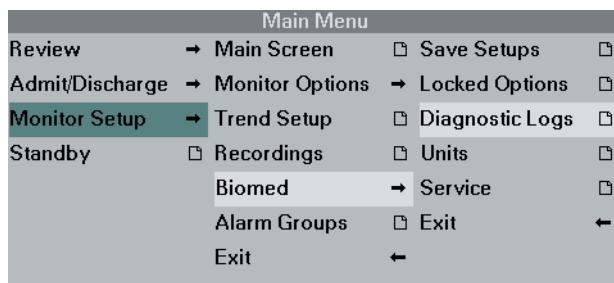
5. Click on **Diagnostic Logs**.

6. The monitor displays the diagnostic log. Turn the rotary knob clockwise to scroll back to previous messages. Turn the knob counterclockwise to scroll forward to current messages.

Changing Units of Measure

You can change the units of measure for the following parameters:

- Temperature — °C (default) or °F
- etCO$_2$ — Vol.% (default), mmHg or kPa
- Pressures — mmHg (default) or kPa
- ST — mm (default) or mV

Upon changing the unit of measure, the monitor displays the New Patient? prompt. You must admit a new patient and thereby discharge the current patient, or the change of units does not take effect.

STEPS: Changing Units of Measure

1. Press the **Menu** fixed key.

2. Click on **Monitor Setup**.

3. Click on **Biomed**.

4. Enter the Biomed password and click the knob.

5. Click on **Units**.

6. Change the units for the desired parameter and click the knob.

7. Click on **New Patient? Yes**.

D Technical Data

Overview

This appendix contains technical specifications for the physical and functional aspects of the Infinity Gamma Series patient monitor and its monitoring accessories. Upon request, Dräger makes technical information required for maintenance and/or calibration of serviceable items available to qualified technical personnel.

For specifications of wireless monitoring accessories such as wireless LAN PC cards and access points, please refer to the documentation of the wireless component's manufacturer, Cisco Systems, Inc.

Regulatory Compliance

Regulatory Standards Compliance

- Medical Device Directive (MDD) 93/42 EEC
- IEC 60601-1 and applicable collateral and particular standards
- EN 60601-1-2: Susceptibility -- IEC 801-2, 3, 4, and 5
- Emissions -- EN 55011, Class B

Basic System Components

Monitor — Base Unit		
Dimensions	Gamma:	196 mm height (7.7 in) 249 mm width (9.8 in) 134 mm depth (5.3 in)
	Gamma XL:	196 mm height (7.7 in) 267 mm width (10.5 in) 147 mm depth (5.8 in)
Weight (without etCO₂)	Gamma:	3.42 kg (7.54 lb) with lead acid battery 3.22 kg (7.10 lb) with lithium ion battery 2.87 kg (6.32 lb) without battery
	Gamma XL:	3.87 kg (8.54 lb) with lead acid battery 3.67 kg (8.10 lb) with lithium ion battery 3.32 kg (7.32 lb) without battery
Materials	Plastics: ABS, FR 110 Printed Circuits: glass/epoxy, lead/tin solder, copper etch, lithium battery Battery: sealed lead acid, or lithium ion (option) Heatsink: cast aluminum NBP assembly: silicon tubing, steel, copper wire Packing: corrugated cardboard, urethane foam	
Disposal	All materials must be disposed of or recycled properly and in accordance with local regulations. There are no known special disposal requirements for any accessories.	
Battery Pack	Lead Acid: PANASONIC LC-T121R8PU or equivalent Li-ion: Dräger Li+ Battery Pack	
Protection Class	Internally powered, for use with specified Class I power supply	
Mode of Operation	Continuous (with external source of power via AC adapter, CPS, or IDS).	
DC Input	11 – 14 VDC, 2.5A	
Battery Operating Time (NBP measurements every 15 minutes, no etCO₂, at 25°C)	Lead acid: 75 minutes Lithium ion: 180 minutes	
Battery Recharging Time	Lead acid: 5½ hours, typical. Lithium ion: 8 hours, typical.	

Patient Leakage Current	< 10μA @ 110 V and 60 Hz < 10μA @ 220 V and 50 Hz
QRS Sync. Output	Output will go high for 100 ms every time a QRS is detected. QRS detected: +12 V ±5%, 5.1 KΩ source impedance. Output low (no QRS): < .8 V @ 30 mA sync current.
Alarm Output	12 V 560 Ω output for external alarm indicator (Nurse Call System)
Recorder	UART output to interface with an R 50 Series recorder through the interface plate.

Monitor Display	
Type	Color Liquid Crystal Display (LCD)
Size	Gamma: 6.5 " (16.5 cm) Gamma XL: 8 " (20 cm)
Display Area	Gamma: 132.5 mm x 99.4 mm Gamma XL: 170.9 mm x 129.6 mm
Matrix	640 x 480 pixels
Pixel Pitch	Gamma: 0.207 x 0.207 mm Gamma XL: 0.267 x 0.270 mm
Number of Channels	Gamma: 3 (or 4 as an option) Gamma XL: 4
Sweep Speeds	Fixed 25 mm/s ±20% for ECG, SpO_2, and IBP curves Fixed 6.25 mm/s ±20% for Resp and $etCO_2$ curve Fixed 1.0 mm/s ±20% for optional OCRG curve
Display Mode	Erase bar (updates waveforms from left to right)

Environmental requirements (Base Unit and AC Power Adapter)	
Cooling	Convection and cooling chimney (no fan)
Temperature	**Operating:** 0 °C to +40 °C (without recorder) **Storage**: –20 °C to 50 °C
Relative Humidity	**Operating:** > 30% and < 95%, non-condensing **Storage:** > 10% and < 95% non-condensing
Altitude	**Operating:** -381 to +3048 m (-1250 to +10000 ft.) 525 to 795 mmHg (70 to 106 kPa) **Storage**: -381 to +5486m (-1250 to +18000 ft.) 375 to 795 mmHg (50 to 106 kPa)
Transportation (with shipping package)	Per National Safe Transit Association (NSTA)
Vibration	5-30 Hz 0.025DA, 30-500 Hz 1 G peak, 1 octave/min sweep rate 14200 vibratory impacts with a total movement of 1"
Drop	Per IEC68-2-31, Packaged drop- 30"
Shock	50 G peak, 11 ms duration, 3 positive and 3 negative pulses in each axis.
Water Resistance	Drip-Proof (IPX 1)

AC Power Adapter (59 53 539 E530U)	
Power Requirements	100-120 VAC, 0.8A 200-240 VAC, 0.4A
Output	Max. 34 W
Frequency	50-60 Hz
Chassis Leakage Current	≤300 μA @ 110 V and 60 Hz (UL 544) ≤500 μA @ 220 V and 50 Hz (IEC 601-1)
Mode of Operation	Continuous
Protection Class	Class I

Infinity Docking Station (IDS)	
Power Requirements	0.7 A @12 V with no devices attached
Mains Frequency	n/a
Mode of Operation	Continuous
Protection Class	n/a
Dimensions	228 mm (w) x 210 mm (d) x 102 mm (h) (9" x 8.25" x 4")
Weight	2 kg (4.5 lbs)
Environmental Requirements	Temperature: (operating:) 10 to 40 °C (50 to 104 °F) (storage:) -20 to 50 °C (-4 to 122 °F) Relative Humidity: (operating:) 20 to 90%, non-condensing (storage:) 10 to 95%, with packaging Atmospheric Pressure: (operating:) 525 to 795 mmHg (70 to 106 kPa) (storage:) 375 to 795 mmHg (50 to 106 kPa)
Finish	Color: Anthracite gray Materials: ABS Polycarbonate blend (injection molded plastic), and die-cast aluminum
Connectors	SC5000/6000/9000 Series, Auxiliary Docking Station, External VGA display, R50 Recorder, Infinity network connection, CAN bus, Communication ports 1 & 2.
Chassis Leakage Current	n/a

Infinity Docking Station (IDS) Power Supply 59 55 393 E530U	
⚠	*CAUTION:* *This Power Supply has a switch used to select nominal line operating voltage. Make sure that the switch is in the correct position for your nominal voltage as indicated on the power supply itself. Incorrect position of the switch could result in damage to the supply and injury to personnel. For further details, refer to the installation instructions.*
Connections	AC Power Connector, DC Power Cable/Connector, Potential Equalization Conductor
Cooling	Convection
Dimensions	135 mm (w) x 111 mm (d) x 270 mm (h) (5.3" x 4.4" x 10.6") Without mounting bracket the depth is 71 mm (2.8").
Weight	1.85 kg (4.1 lbs)
Power Requirements	100-120VAC, 3.4 A or 200-240VAC, 1.7 A (**switch selectable**)
Mains Frequency	50/60 Hz
Power Output	+13 VDC, 10.8 Amps
Protection Class	Class I
Chassis leakage current	<300 µA @120VAC, <500 µA @220VAC
Mode of Operation	Continuous
Ingress Protection	Ordinary
Environmental Requirements	Temperature: (operating:) 10 to 40 °C (50 to 104 °F) (storage:) -40 to 70 °C (-40 to 158 °F) Relative Humidity: (operating:) 20 to 95%, non-condensing (storage:) 10 to 95%, with packaging Atmospheric Pressure: (operating:) 525 to 795 mmHg (70 to 106 kPa) (storage:) 375 to 795 mmHg (50 to 106 kPa)

Infinity Docking Station (IDS) Power Supply (55 84 912 E530U and 59 49 271 E530U)	
Connections	AC Power Connector, DC Power Cable/Connector, Potential Equalization Conductor
Cooling	Convection
Dimensions	135 mm (w) x 111 mm (d) x 270 mm (h) (5.3" x 4.4" x 10.6") Without mounting bracket the depth is 71 mm (2.8").
Weight	1.85 kg (4.1 lbs)
Input Voltage Range	55 84 912 E530U: 100-120 VRMS, 200 - 240 VRMS 59 49 271 E530U: 200-240 VRMS
Mains Frequency	50/60 Hz
Power Consumption	55 84 912 E530U: 3.4 A 59 49 271 E530U: 1.6 A
Power Output	+13 VDC, 10.8 Amps
Protection Class	Class I
Chassis leakage current	<300 µA @120VAC, <500 µA @220VAC
Mode of Operation	Continuous
Ingress Protection	Ordinary
Environmental Requirements	Temperature: (operating:) 10 to 40 °C (50 to 104 °F) (storage:) -40 to 70 °C (-40 to 158 °F) Relative Humidity: (operating:) 20 to 95%, non-condensing (storage:) 10 to 95%, with packaging Atmospheric Pressure: (operating:) 525 to 795 mmHg (70 to 106 kPa) (storage:) 375 to 795 mmHg (50 to 106 kPa)
Note that 55 84 912 E530U is for use with input voltage range of 100-120 VRMS, and 59 49 271 E530U is for use with input voltage range of 200-240 VRMS.	

Monitoring Accessories

etCO2 Pod	
Size (H x W x D)	Pod: approx. 140 x 140 x 51 mm (5.5 x 5.5 x 2 in) Capnostat™ III Sensor (without cable): 33 x 42 x 22 mm (1.3 x 1.7 x 0.9 in.)
Weight	Pod: 1.1 lb or .5 kg Capnostat™ III Sensor: 18 g
Connections	Sensor connector, female luer side-stream sampling port, male luer sample exhaust port
Adult Airway Adapter Dead Space	< 5 cc
Neonatal Airway Adapter Dead Space	< 0.5 cc
Moisture Resistance	Airway adapter can be immersed in water without damage
Biotoxicity	None per ASTM F720 (MTL #2009)
Power Source	Powered directly from monitor
Protection Against Electric Shock	Type CF (per IEC 601-1)
Mode of Operation	Continuous
Defibrillation Protection	per IEC 601-1 A2
Mechanical Shock	20 one-meter drops per IEC 68-2-32 (1990), EN 60068-2-32 (1993)
Environmental Requirements (Readings comply to BTPS = Body temperature of 37°C, ambient barometric pressure of 750 mmHg, and relative humidity of 100%.)	Temperature: (operating:) 10 to 40 °C (50 to 104 °F) (storage:) -20 to 50 °C (-4 to 122 °F) Relative Humidity: (operating:) 20 to 90%, non-condensing (storage:) 10 to 95% (with packaging) Atmospheric Pressure: (operating:) 525 to 795 mmHg (70 to 106 kPa) (storage:) 375 to 795 mmHg (50 to 106 kPa)

Scio Multigas Module	
Size (H x W x D) with watertrap	122 x 222 x 300 mm (4.8 x 8.7 x 11.7 in.)
Weight	3.0 kg (6.6 lbs)
Cooling	Fan
Mains Frequency	50/60 Hz
Power Requirement	< 0.8 A at 100-120 Vac; <0.4 A at 200-240 Vac
Chassis Leakage Current	$\leq$ 300 μA (per UL 544) $\leq$ 500 μA (per IEC 60601-1)
Electric Shock Protection	Type BF
Protection Class	Class 1
Mode of Operation	Continuous
Power	From specified power supply
Sound Pressure Level	$\leq$ 45 dB(A)
Air Ingression, Leakage	< 45 ml during zeroing, < 10 ml/min leakage
Sample Flow Rate	150 ml/min. ± 20 ml/min.

Environmental Requirements
(Readings comply to ATPS conditions = Ambient Temperature Pressure Saturated)
	Temperature:
	  (operating:) 10 to 40 °C (50 to 104 °F)
	  (storage:) -20 to 70 °C (-4 to 158 °F)
	Relative Humidity:
	  (operating:) 5 to 90%
	  (storage:) 5 to 95%
	Atmospheric Pressure:
	  (operating:) 525 to 795 mmHg (70 to 106 kPa)
	  (storage:) 375 to 795 mmHg (50 to 106 kPa)

R50 N Network Recorder	
Dimensions	180 x 120 x 222 mm (7.1 x 4.72 x 8.74 in.)
Weight	1.64 kg (3.6 lb)
Connections	AC Power Connector, Infinity Network, R50 Recorder, Potential Equalization Connector.
Cooling	Convection
Input voltage range	100-240 VRMS
Mains frequency	50/60 Hz
Power Consumption	1.0 A max
Protection Class	Class I
Chassis Leakage Current	<300 mA @ 120VAC, <500 mA @ 220VAC
Mode of Operation	Continuous
Water Resistance	Ordinary
Environmental Requirements	Temperature: Operating: 15°C to 40°C (55°F to 104°F) Storage: -20°C to 40°C (-4°F to 104°F) Relative Humidity: Operating: 30% to 95%, non-condensing Storage: 10% to 95%, non-condensing with packaging Atmospheric Pressure: Operating: 550 to 775 mmHg (73 to 103 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)

Monitoring Specifications

ECG	
Accessories	3-,5-, and 6-Lead patient cable
Input Connector	2-pin connector to MultiMed pod
Input Parameters	3-Lead (RA, RL, LA and LL electrodes) 5-Lead (RA, RL, LA, LL and CHEST electrodes) 6-Lead (RA, RL, LA, LL and 2 CHEST electrodes)
Number of Channels	2
Sweep Speed	25 mm/s
Resolution	1/min.
Measurement Range	15 to 300 1/min.
Measurement Accuracy	±5 beats/minute or ±2%, whichever is greater
Response Time	< 7 seconds for a step change of 80 to 120 1/min. < 13 seconds for a step change of 80 to 40 1/min. • Response time is measured from the onset of the first QRS complex of the new rate to the time the measurement reads a value that is the original rate plus 63% of the change.
Report Interval (nominal)	2.1 seconds
Notch Filter Frequency	50/60 Hz
Monitor ±3 dB Band-width	0.5 Hz to 28 Hz (50 Hz) 0.5 Hz to 40 Hz (60 Hz)
Dynamic Range AC	±10 mV minimum
Dynamic Range DC	± 1 V minimum
Resolution	10.4 μV
Electrode Off Impedance	> 100 MΩ
Electrode On Impedance	< 40 MΩ
Calibration Spike	1 mV ±5% amplitude, 20 msec duration
Defibrillation Protection	In accordance with IEC 601-2-27

Degree of Protection Against Electric Shock	CF
Pacer Pulse Detection	On active ECG lead
Pacer Pulse Detection Level	Amplitude: ± 5 to ± 700 mV Width: 0.1 to 2.0 ms Separation between pulses: ≥30 ms Recharge time constant: 4 to 100 ms Over/Undershoot: 0.025 a_p 2 mV maximum
Lead Off Sensing Current	<50 nA DC from LL, LA, RA and V Leads

Arrhythmia	
Measurement Range	0 to 300 beats/minute
Display Resolution	1 beat/minute
Accuracy	± 5 beats/minute or ± 10% of the rate, whichever is greater
Response Time	< 4 seconds

ST Segment Analysis	
Measurement Range	-15 mm to +15 mm (-1.5 mV to +1.5 mV)
Accuracy	±1mm/0.1mV RTI
Isoelectric Point Range	From start of the averaged ST complex to Fiducial Point, in increments of 4 ms
ST Point Range	From Fiducial Point to end of the averaged ST complex, in increments of 4 ms
Display Resolution	0.1 mm/0.01mV (10μV)
Response Time	15 seconds

Respiration	
Method	Impedance Pneumography
Sensing Electrodes	RA and LL (Lead II)
Number of Channels	1
Sweep Speed	6.25 mm/s
Resolution	1 breath per minute
Measurement Range	0 to 155 breaths per minute
Measurement Accuracy	± 1 breath per minute, or ± 2%, whichever is greater
Response Time	After a step change in respiration rate, it takes 36 seconds to stabilize to a new respiration rate of 10 breaths per minute and 18 seconds to stabilize to a new respiration rate of 20 breaths per minute.
Report Interval	2 seconds
Total resistance	0 to 3600 Ω
Input Dynamic Range	AC: ± 17.3 Ω ± 10% DC: 0 Ω to 3.6 kΩ (internal check for high impedance)
Bandwidth	0.25 Hz to 3.5 Hz
Impedance Measuring Current	65 μA RMS ±10% nominal at 48kHz ±1%, rectangular wave

etCO$_2$	
Parameter Display	etCO2, iCO2, Respiration Rate (RRc)
Measuring Method	Dual wavelength, non-dispersive infrared absorption
Measuring Modes	Adult and Pediatric: Mainstream and Sidestream Neonatal: Mainstream only
Warm-Up	$\leq$5 min (at 25 °C)

etCO$_2$ (continued)	
Measurement Range	etCO$_2$: 0-100 mmHg iCO$_2$: 0-10 mmHg RRc: 5-145 bpm

Accuracy	etCO$_2$: ±2 mmHg for 0-40 mmHg
	        ±5% reading for 41-70 mmHg
	        ±8% reading for 71-100 mmHg
	iCO$_2$: ±2 mmHg
	RRc: 1 bpm
	Stable over 24 hours, over full range of readings at atmospheric pressure.

Calibration	Verify once a day. Calibrate when moving the sensor from one module to another. Calibration time: < 20 s
Compensation	Gas/Anesthetic agent: User-selectable Atm. pressure: Automatic or user-selectable (540 - 800 mmHg)
Sampling Flow Rate	180 ±12 ml/min (Sidestream measuring mode)
Apnea Detection	Yes
RRc Range (Pod)	Mainstream: 0-149 breaths/min Sidestream: 0-69 breaths/min Accuracy: ±1 breath/min
Rise Time	Mainstream: <100 ms Sidestream: <200 ms
Delay Time	Mainstream: <100 ms Sidestream: <450 ms
Total System Response Time	Rise time plus delay time
Resolution	etCO$_2$/iCO$_2$: 1 mmHg, RRc: 1bpm
Average Response Time	< 75ms from sensor
Breath Detection Threshold	5 mmHg or greater

etCO$_2$ (continued)	
Degree of Protection Against Electric Shock	CF
Defibrillation Protection	In accordance with IEC 601-1A2

Multigas	
Parameter Labels	CO2, O2, N2O, HAL, ISO, ENF, SEV, DES
Agents Monitored	Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane
Measuring Methods	CO2, N2O, Agents: Infrared O2: Paramagnetic Sensor
Display	Inspired and expired concentrations (%) and etCO2 waveform
Display Ranges	CO2: 0-10 vol% (increments of 1) O2: 5-100 vol% (increments of 1) N2O: 0-100 vol% (increments of 1) Halothane: 0-8.5 vol% (increments of 0.1) Isoflurane: 0-8.5 vol% (increments of 0.1) Enflurane: 0-10 vol% (increments of 0.1) Sevoflurane: 0-10 vol% (increments of 0.1) Desflurane: 0-22 vol% (increments of 0.1)
Full Accuracy (after a warm-up period of approximately 5 minutes)[1]	CO2: ± 0.5 vol% or ± 12% rel. (whichever is greater) O2: ± 3 vol% N2O: ± (2 vol% + 8% rel.) Halothane (up to 8.5 vol%): ± (0.15 vol% + 15% rel.) Isoflurane (up to 8.5 vol%): ± (0.15 vol% + 15% rel.) Enflurane (up to 10 vol%): ± (0.15 vol% + 15% rel.) Sevoflurane (up to 10 vol%): ± (0.15 vol% + 15% rel.) Desflurane (up to 20 vol%): ± (0.15 vol% + 15% rel.)
Rise Time (10% to 90% at a flow rate of 150 ml/min.)	CO2: <500 ms O2: <650 ms N2O: <500 ms Agents: <500 ms
Delay Time (with Water Trap and 2.5 m Sampling Line)	< 4 sec

[1]Due to the response time of the sensors and the gas sample flow rate, the stated accuracy of O_2, CO_2, N_2O and the anesthetic agents is limited by the respiratory rate and by the inspiratory to expiratory ratio (I:E) as follows:

For O_2 measurements, accuracy is maintained up to a respiratory rate of 60 breaths/min. with an I/E ratio of 1:2.

For CO_2 measurements, accuracy is maintained up to a respiratory rate of 75 breaths/min. with an I/E ratio of 1:2.

For N_2O measurements, accuracy is maintained up to a respiratory rate of 75 breaths/min. with an I/E ratio of 1:2.

For agent measurements, accuracy is maintained up to a respiratory rate of 60 breaths/min. with an I/E ratio of 1:2.

The effect of respiratory rate and I/E ratio settings on accuracy were determined in a simulated breathing system using square wave gas concentration waveforms.

Pulse Oximetry (SpO_2)	
Parameter Display	Saturation (%SpO_2), pulse rate
Measuring Method	Absorption-spectrophotometry
Measuring Range	SpO_2: 1 - 100% Pulse rate: 15 - 300 1/min
Calibration Range	70-100%
Display Range	0-100%
Display Update Period	2 seconds
Maximum Hold from Previous Update	30 seconds (in the event of artifact or other error)

Measuring accuracy, Adult mode[1]:

SpO_2:
0 to 69% not specified
70 to 100% sensor-specific as follows:

Nellcor : [2,3]
   D-25/D-25L, D-20, I-20, N-25, ...±2
Nellcor :
   DS100A ....±3
Masimo: [2,3]
   LNOPADT, LNOPPED, LNOPNEO, LNOPNEO SS,LNOP-YI ....±2
Masimo:
   LNOP-DCI, LNOP-DCIP, NR125 ....±2
   EAR ....±3.5
Pulse Rate: .... ±3 beats/min or ±3% (whichever is less)

Measuring accuracy, Neonatal mode[1, 2, 3, 4]:

SpO_2:
0 to 69% not specified
70 to 100% sensor-specific as follows:

    Nellcor:
      N-25 ....±3
    Masimo:
      LNOPNEO, LNOPNEO SS, LNOP-YI.....................................±3
Pulse Rate: .... ±3 beats/min or ±3% (whichever is less)

Notes:

1) SpO_2 accuracies are expressed as ± "X" digits between indicated saturation levels. Accuracy of the SpO_2 measurement is specified with 1 SD (standard deviation), which represents approximately 68% of the population.

2) Saturation: increase tolerance by ±1 digit during motion[5, 6] (ECG monitoring required).

3) Pulse Rate: increase tolerance by ±2 beats/min or ±2% (whichever is greater) during motion[5, 6] (ECG monitoring required).

4) Accuracy of saturation measurements on neonates is increased by ±1 digit as compared to accuracy on adult patients to account for the theoretical effect on oximeter measurements of fetal hemoglobin in neonatal blood.

5) For Masimo devices, motion is defined as either:
   • Periodic rubbing/tapping with an amplitude of 1-2 cm. at a periodic frequency of 2-4 Hz.
   or:
   • Aperiodic motion with an amplitude of 2-3 cm. at a frequency of 1-5 Hz.

6) For Nellcor devices, motion is defined as aperiodic rubbing/tapping motion with an amplitude of 1-2 cm. at a frequency of 1-4 Hz.

SpO_2 Alarms	High: Adjustable, 20 to 100% Low: Adjustable, 20 to 100% Defaults: Adult and Pediatric: 100-90 Neonatal: 100-90
Nominal Wavelength	Red: 660 nm IR: 910 nm
Power	Red: 3 mW (max.) IR: 4 mW (max.) Note: LED drive is current limited by hardware mechanisms.
Degree of Protection Against Electric Shock	Type CF
Defibrillation Protection	In accordance with IEC 601-1A2

Temperature	
Input Connector	7-pin connector on MultiMed pod
Measurement Range	0 °C to +50 °C (32 °F to 122 °F)
Measurement Accuracy	±0.1 °C for a range of 0 °C to 50 °C
Probe Accuracy	±0.1 °C for a range of 0 °C to 50 °C
Total System Accuracy	±0.2 °C for a range of 0 °C to 50 °C
Average Response Time	< 2.5 seconds
Linearity	Linearity calculations to 0.02 °C by the software algorithm.
Excitation Signal	DC source
Power to Probe	< 50 μW (causing a potential self-heat error factor of < 0.05 °C)
Test Signals	– 5 °C and 50 °C ±0.1 °C with nominal thermistor
Filter Characteristic	Low-pass filtering to minimize noise pickup.
Error Detection	> 50 °C: high temperature, possibly caused by a shorted thermistor. –3 °C: low temperature, possibly caused by an open thermistor. Self-test failure
Degree of Protection Against Electric Shock	CF
Defibrillation Protection	In accordance with IEC 601-1A2

Non-Invasive Blood Pressure (NBP)	
Parameter Display	Systolic, Diastolic, Mean
Measuring Method	Oscillometric technique
Modes of Operation	Manual (single measurement), Continuous (5 minutes), or Interval
Interval Times	2, 2.5, 3, 5, 10, 15, 20, 25, 30, 45, 60, 120, and 240 min

Measuring Range (Adult - 270mmHg)	Heart rate:	30 - 240 bpm
	Systolic NBP:	30 - 250 mmHg
	Mean NBP:	20 - 230 mmHg
	Diastolic NBP:	10 - 210 mmHg
Measuring Range (Adult - 180mmHg)	Heart rate:	30 - 240 bpm
	Systolic NBP:	30 - 170 mmHg
	Mean NBP:	20 - 150 mmHg
	Diastolic NBP:	10 - 130 mmHg
Measuring Range (Pediatric - 180mmHg)	Heart rate:	30 - 240 bpm
	Systolic NBP:	30 - 170 mmHg
	Mean NBP:	20 - 150 mmHg
	Diastolic NBP:	10 - 130 mmHg
Measuring Range (Pediatric - 140mmHg)	Heart rate:	30 - 240 bpm
	Systolic NBP:	30 - 130 mmHg
	Mean NBP:	20 - 110 mmHg
	Diastolic NBP:	10 - 130 mmHg
Measuring Range (Neonatal - 140mmHg)	Heart rate:	30 - 240 bpm
	Systolic NBP:	30 - 130 mmHg
	Mean NBP:	20 - 110 mmHg
	Diastolic NBP:	10 - 100 mmHg
Measuring Range (Neonatal - 90mmHg)	Heart rate:	30 - 240 bpm
	Systolic NBP:	30 - 80 mmHg
	Mean NBP:	20 - 70 mmHg
	Diastolic NBP:	10 - 60 mmHg
Connections	Quick-release hose connector with single airway	
Default Inflation Pressure	Adult (270):	180 mmHg ±5 mmHg
	Adult (180):	130 mmHg ±5 mmHg
	Pediatric (180):	130 mmHg ±5 mmHg
	Pediatric (140):	110 mmHg ±5 mmHg
	Neonatal (140):	110 mmHg ±5 mmHg
	Neonatal (90):	80 mmHg ±5 mmHg
Inflation Pressure After a Valid Measurement (±5 mmHg)	Adult (270):	Previous NBP_{SYS} + 25 mmHg
	Adult (180:	Previous NBP_{SYS} + 25 mmHg
	Pediatric (180):	Previous NBP_{SYS} + 25 mmHg
	Pediatric (140:	Previous NBP_{SYS} + 30 mmHg
	Neonatal (140):	Previous NBP_{SYS} + 30 mmHg
	Neonatal (90):	Previous NBP_{SYS} + 20 mmHg
Inflation Pressure After an Alarm	Adult (270):	180 mmHg ±5 mmHg
	Adult (180):	130 mmHg ±5 mmHg
	Pediatric (180):	130 mmHg ±5 mmHg
	Pediatric (140):	110 mmHg ±5 mmHg
	Neonatal (140):	110 mmHg ±5 mmHg
	Neonatal (90):	80 mmHg ±5 mmHg
Maximum Inflation Pressure	Adult (270):	265 mmHg ±5 mmHg
	Adult (180):	180 mmHg ±5 mmHg
	Pediatric (180):	180 mmHg ±5 mmHg
	Pediatric (140):	142 mmHg ±5 mmHg
	Neonatal (140):	142 mmHg ±5 mmHg
	Neonatal (90):	80 mmHg ±5 mmHg

Minimum Inflation Pressure	Adult (270):	110 mmHg ±5 mmHg
	Adult (180):	90 mmHg ±5 mmHg
	Pediatric (180):	90 mmHg ±5 mmHg
	Pediatric (140):	70 mmHg ±5 mmHg
	Neonatal (both):	70 mmHg ±5 mmHg
Maximum Measurement Time	Adult (both):	2 min ±1 sec
	Pediatric (both):	2 min ±1 sec
	Neonatal (both):	90 sec ±1 sec (60s French homologation)
Maximum Measurement Time Including a Retry	Adult (both):	3 min ±1 sec
	Pediatric (both):	--- (n/a)
	Neonatal (both):	--- (n/a)
Software Safety Cut-Off	Adult (270):	273 ±3 mmHg
	Adult (180):	210 ±3 mmHg
	Pediatric (180):	210 ±3 mmHg
	Pediatric (140):	150 ±3 mmHg
	Neonatal (both):	150 ±3 mmHg
Hardware Safety Cut-Off	Adult (both):	300 ±30 mmHg
	Pediatric (180):	300 ±30 mmHg
	Pediatric (140):	157 ±8 mmHg
	Neonatal (both):	157 ±8 mmHg
Static Cuff Accuracy	±3 mmHg	
Calibration Range	Adult and Pediatric:	10 - 260 mmHg ±3 mmHg
	Neonatal:	10 - 150 mmHg ±3 mmHg
Degree of Protection Against Electric Shock	Type CF	
Defibrillation Protection	per EN 60601-2-30 (IEC 601-2-30)	

Invasive Blood Pressure (IBP1, IBP2*)	
Accessories	Transducers with a resistance of 300 to 2000Ω and an equivalent pressure sensitivity of 5 μV/V/mmHg ±10%
Input Connector	7-pin connector on monitor
Number of Channels	2 max (2 with IBP2 option)
Sweep Speed	25 mm/s
Measured Parameters	Systolic, Mean and Diastolic blood pressure
Measurement Range	-50 mmHg to 399 mmHg

Measurement Accuracy	±2 mmHg or ±3% (whichever is greater) after successful zero and calibration (exclusive of transducer).
Resolution	1 mmHg or 0.1 kPa
Response Time	≤35 s (to reach 90% of the change of the lowest pulse rate of 25 1/min.
Zero Balance Range	±190 mmHg
Zero Resolution	0.24 mmHg
Zero Accuracy	±0.48 mmHg
Bandwidth	DC to 16 Hz
Defibrillation Protection	In accordance with IEC 601-2-34
Degree of Protection Against Electric Shock	CF

Glossary

The following list explains terms and abbreviations you may encounter while reading this guide.

AC	Alternating Current
ARR	Arrhythmia
ART	Arterial Pressure
ASY	Asystole
aVF	Foot augmented lead
aVL	Left arm augmented lead
aVR	Right arm augmented lead
Battery-backed memory	The circuits inside the monitor that retain information after turning off the monitor. The monitor uses a special long-life battery to protect the circuits. Patient settings, for example, are saved in battery-backed memory.
BRDY	Bradycardia
Care Unit	Group of devices that have the same department identification, e.g. CCU, ICU, SICU.
CCU	Cardiac Care Unit
Communication Power Supply (CPS)	A hardware component that provides DC power and a communication link to the Infinity™ network.
CVP	Central Venous Pressure
D or Dia	Diastolic pressure
Docking Station™	A mounting device that supports the monitor mechanically and that provides connections to the Communication Power Supply (CPS) module. See also Pick and Go.
ECG	Electrocardiogram
ESU	Electro-surgical unit
Ethernet	A popular baseband local area network (LAN) standard. Dräger's Infinity™ network is an Ethernet LAN-based network.
Fixed keys	Keys located on the front of the monitor. These keys control various functions, including display, power, NBP measurements, and recordings.

G	Gravity force
Global recorder	A recorder shared by many devices on the network.
GP1, GP2	Generic Pressure1, Generic Pressure 2
hr	Hour
Hz	Hertz
ICP	Intra Cranial Pressure
ICU	Intensive Care Unit
IDS	Infinity Docking Station
in.	Inches
Infinity™ Docking Station (IDS)	A hardware component that provides the functionality of both the CPS and the Docking Station. The IDS provides DC power and a communication link to the Infinity™ network, as well as serving as a mounting device that supports the monitor mechanically. See also Pick and Go.
Infinity™ Network	The communication network that links Dräger patient monitors to central stations and peripheral devices.
Interface plate	A hardware connection located under the monitor that enables you to link the monitor with a nurse-call system, an R50 Series recorder, or an external device (using Export Protocol).
kPa	kilopascals
LA	Left Arm
LL	Left leg
LP	Laser Printer
M or Mean	Mean Pressure
μ**A**	Micro Ampere
Main Menu	The top level menu consisting of the following menu options: Review, Admit/Discharge, Monitor Setup, and Standby. This menu is accessed by the Menu fixed key.
Main screen	The display of waveforms and values only (no menus).
Memory	The circuits inside the monitor that store information. Patient data and settings are stored in memory, for example.
Menu	A list of operational functions available on your monitor.
Menu option	An alternative for an operational function available on your monitor.

min	Minute
mm	millimeter
mm/s	Millimeter per second
mmHg	Millimeters of mercury
Monitoring Unit	Group of devices sharing patient data in a network installation.
ms	Millisecond
Multigas Monitoring	Monitoring of O_2, CO_2, N_2O, and of the anesthetic agents halothane, isoflurane, enflurane, sevoflurane, and desflurane with the a multigas module.
MultiMed 5™	The pod that receives the following patient cables: ECG leadset, SpO_2 extension cable and a temperature probe.
MultiMed 6™	The pod that receives the following patient cables: ECG leadset, SpO_2 extension cable and a temperature probe.
MultiView Workstation™	The central station that displays the bedsides of an Infinity™ network installation at the nurses' station. *See also Infinity™ network.*
mV	Millivolt
μV	Microvolt
NBP	Non-invasive Blood Pressure
NeoMed™	Similar to MULTIMED series, it is used exclusively with neonatal patients.
Off-line	Not connected to or served by the network. *See also Standalone.*
On-line	Connected to or served by the network.
PA	Pulmonary Artery Pressure
Parameter	A monitored physiological function (e.g., heart rate).
Parameter boxes	The areas of the screen where parameter labels and values are displayed.
Parameter labels	The designation of specific physiological parameters that are displayed in the parameter boxes (e.g., HR, SpO_2). Parameter labels are used to call up a menu on the screen.
Pick and Go™	A design concept for the bedside monitors. The Dräger PICK AND GO™ concept makes it possible for the monitors to travel with the patient from one clinical station to another.
PLS or Pls	Pulse Rate

PVC/min	Premature Ventricular Contractions per minute
R50 Series Recorder	Recorder used to print a paper copy of patient data (alarms and waveforms). The R50 Series recorder connects to the bedside monitors via the interface plate, the CPS, or IDS.
RA	Right arm
RL	Right leg
S or Sys	Systolic pressure
sec	Second
ST	ST Segment
Standalone	Bedside monitor operating independently of a monitoring network.
Strip-chart	The paper copy of patient data from a recorder.
SYNC or sync	Synchronization
TCP/IP	Acronym for Transaction Control Protocol/Internet Protocol. Communication protocol for the Infinity™ network. *See also Infinity™ network.*
TENS	Transcutaneous Electric Nerve Stimulators
UPS	Acronym for Uninterruptible Power Supply. The UPS is a backup power source for the central station in case the main electrical source fails. The UPS ensures that the central station is never off-line and unable to report alarms.
V	Volt
V, V+	Chest
VF or V Fib	Ventricular fibrillation
VGA video display	A 15-inch video display that is used to view the bedside monitor display. The VGA display has no rotary knob or fixed keys.
VT or V Tach	Ventricular Tachycardia
Ω	Ohm

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